

Annals of the Missouri Botanical Garden

VOL. 21

SEPTEMBER, 1934

No. 3

STUDIES IN GRINDELIA. II^{1, 2}

A MONOGRAPH OF THE NORTH AMERICAN SPECIES OF THE GENUS GRINDELIA

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INTRODUCTION

Since *Grindelia* was established by Willdenow³ in 1807, it has been recognized by practically all botanists as one of the most distinct and homogeneous genera in the Compositae. Because of this homogeneity, somewhat analogous to the situation in *Viola*, *Rubus*, *Crataegus*, *Salix*, etc., from the outset there has been difficulty in differentiating the various species. All authors seem to have avoided detailed study of the species and their relationships, and as a result the genus as a whole has never received a critical comprehensive monographic treatment. In 1931 Cabrera⁴ published a comprehensive re-

¹ Studies in *Grindelia*. III, to be published subsequently, will contain a detailed discussion of the history, morphology, geographical distribution, phylogeny, economic uses, and relationships of the genus.

² An investigation carried out at the Missouri Botanical Garden in the Graduate Laboratory of the Henry Shaw School of Botany of Washington University and submitted as a thesis in partial fulfillment of the requirements for the degree of doctor of philosophy in the Henry Shaw School of Botany of Washington University. (Abridged for publication.)

³ Willdenow, C. L., *Mag. Nat. Fr. Ber.* 1: 260. 1807.

⁴ Cabrera, A. L., *Revision de las especies Sudamericanas del genero "Grindelia,"* in *Rev. Mus. La Plata* 33: 209. 1931.

Issued September 20, 1934.

ANN. MO. BOT. GARD., VOL. 21, 1934.

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vision of the South American species, but the North American species have had no particular attention since Dr. Gray treated them in the 'Synoptical Flora of North America'; moreover, the Mexican species have never been treated. The present investigation was begun in 1930 and is still being carried on. The lack of any critical work on the group was realized early in the study of historical types. Most of the names were found to have been misapplied, types of species have been misinterpreted, and the specific complexity of the various entities has never been satisfactorily worked out. All these factors contributed to the chaotic condition in the genus, and most of the current names in manuals and floras have had to be changed or dropped and replaced by new or older ones.

In order to cope satisfactorily with such a complex of confused and variable entities, it was necessary to examine large suites of herbarium material, as well as to carry on detailed field and experimental studies. Fortunately, the author has had access to material from the principal herbaria in the United States and from many smaller herbaria and has had the privilege of examining the actual historical types or photographs and fragments of the types of all the North American species and varieties. Field studies have been pursued three consecutive summers, that of 1931 having been spent in the western United States for the purpose of studying the environment and habitats of as many species as possible, and making collections of all the variations. About thirty species and almost as many varieties and forms have been grown from seed at the experimental greenhouses of the Missouri Botanical Garden, and later transplanted outdoors, and detailed studies of the seedling stage have been made.

For the privilege of studying the herbarium material or photographs of material appreciation is hereby expressed to the curators of the various herbaria. Numerous persons have aided the present study in many ways. Especial thanks are due Mr. John T. Howell, of the California Academy of Sciences, for collecting seeds and in carrying on detailed field studies in California; Dr. S. F. Blake, of the United States Department of Agriculture, and Mr. C. A. Weatherby, of the Gray

Herbarium, for helpful suggestions, advice, and information. To Dr. George T. Moore, Director of the Missouri Botanical Garden, the author is under obligation for the use of the excellent library and herbarium and the privilege of doing work in the experimental greenhouses and outside plots. Above all, the writer wishes to express his most sincere appreciation to Dr. J. M. Greenman, Curator of the Herbarium of the Missouri Botanical Garden, and to Dr. B. L. Robinson, Curator of the Gray Herbarium of Harvard University, for the assistance rendered at all times during the course of this study.

ABBREVIATIONS

In the citation of specimens the herbaria from which material or photographs have been studied are indicated by the following abbreviations: S. F. Blake (B); Botanical Garden and Museum of Berlin-Dahlem (BER); British Museum of Natural History (BM); Brigham Young University (BY); University of California (CAL); National Herbarium of Canada (CAN); Carnegie Museum (CAR); California Academy of Sciences (CAS); V. L. Cory (CO); C. C. Deam (D); J. A. Ewan (E); Field Museum of Natural History (F); Gray Herbarium of Harvard University (G); A. O. Garrett (GA); De Candolle Herbarium at Geneva (GEN); Museum d'Histoire Naturelle de Paris (HN); University of Idaho, Southern Branch (IS); W. L. Jepson (J); Royal Botanical Gardens, Kew (K); Missouri Botanical Garden (M); Michigan Agricultural College (MA); University of Missouri (MO); University of Minnesota (MU); Edward L. Greene Herbarium of Notre Dame University (N); New York Botanical Garden (NY); Oregon State Agricultural College (O); F. W. Peirson (P); Academy of Natural Sciences, Philadelphia (PA); Philadelphia Botanical Club (PB); Pomona College (PO); Rocky Mountain Herbarium of the University of Wyoming (R); Santa Barbara Museum (SB); Dudley Herbarium, Stanford University (ST); University of Utah (UU); University of Oregon (UO); United States National Herbarium (US); University of Texas (UT); University of Washington, at Seattle (UW); State College of Washington, Pullman (WSC); Willamette University (WI).

The specimens cited represent only a small portion of the material examined.

TAXONOMY

Grindelia Willd. in Mag. Ges. Nat. Fr. Ber. 1: 260. 1807; Enum. Pl. 2: 894. 1809; R. Br. in Trans. Linn. Soc. Lond. 12: 102. 1818; Dunal in Mem. Mus. Par. 5: 46. 1819; HBK. Nov. Gen. & Sp. 4: 309. 1820; Less. Syn. Gen. Compos. 163. 1832; DC. Prodr. 5: 314. 1836; Endl. Gen. Pl. 383. 1838; Torr. & Gray, Fl. N. Am. 2: 246. 1842; Benth. & Hook. Gen. Pl. 2: 250. 1873; Gray in Cal. Geol. Surv. Bot. 1: 303. 1876; Gray, Syn. Fl. N. Am. 1²: 116. 1884, and ed. 2. 116. 1888; Rob. & Fern. in

Gray's New Man. Bot. ed. 7. 786. 1908; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 489. 1909; Rydb. Fl. Rocky Mts. 847. 1917; Jepson, Man. Fl. Pl. Cal. 1020. 1925.

Donia R. Br. in Ait. Hort. Kew. ed. 2. 5: 82. 1813, not *Donia* R. Br. 1819, nor *Donia* G. Don, 1832.

Thuraria Nutt. in Fras. Cat. 1813, not *Thuraria* Molina, 1782.

Aurelia Cass. in Bull. Soc. Philom. 175. 1815; in Jour. Phys. 89: 32. 1819; Dict. Sci. Nat. 37: 468. 1825, not *Aurelia* J. Gay, 1858.

Demetria Lag. Gen. & Sp. Nov. 30. 1816.

Hoorebekia Corn. in Mussche, Hort. Gand. 13. 1817.

Doniana Raf. Am. Month. Mag. 268. 1818.

Herbaceous or suffruticose, caulescent, glabrous or pubescent annuals, biennials, or perennials. Stem simple and monocephalous to corymbosely or paniculately much-branched, with few to numerous heads. Leaves alternate, sessile or the lower and basal petiolate, simple, entire to pinnatifid, more or less resinous-punctate. Heads discoid or radiate, homochromous, when radiate heterogamous, many-flowered. Disk depressed-hemispherical to deeply campanulate. Involucre more or less resinous, 4-8-seriate, the involucral bracts mostly graduate, linear- or filiform-subulate to ovate-lanceolate, with short acute to elongated apices, the lower part more or less indurated and appressed to the disk, the upper part erect and appressed, ascending to strongly revolute, glabrous or pubescent, flattened to terete, entire, at least the inner bracts resinous-punctate. Receptacle flat to very slightly convex, more or less deeply foveolate, the receptacular processes often well developed into linear or ovate, acute to acuminate projections resembling reduced paleae. Ray-florets 15-45, ligulate, pistillate, fertile, the ligules pale lemon-yellow to orange, linear-oblong to broadly oblong-spatulate, obtuse to acute, subentire to obscurely 3-lobed at apex. Disk-florets perfect, tubular, yellow, the throat gradually or abruptly constricted about half-way into a slender tube, the limb 5-toothed. Anthers with acutish to obtuse, entire, broadly deltoid or ovate bases, the terminal appendages more or less elongated, oblong-lanceo-

late to ovate, acutish or obtuse; style-branches of ray-florets straight, erect or ascending, slender, glabrous or essentially so throughout, without dorsally hispidulous terminal appendages; style-branches of disk-florets straight, erect, ascending or slightly spreading, with terminal appendages narrowly linear-lanceolate to ovate-oblong, and sparsely to densely hispidulous or hirsutulous-pubescent on the surface and along margins, the papillate stigmatic lines extending along the margins of the stylar branches to the base of the terminal appendage. Pappus of disk- and ray-florets of mostly 2–10 (rarely up to 15) caducous, entire to numerously setulose, slender, nearly capillary to strongly paleaceous awns. Achenes narrowly oblong to broadly rhomboid or cuboid, horizontally truncate to 1–3-knobbed, with tooth-like processes or irregularly shallowly to conspicuously undulately bordered at apex, the pericarp glabrous, smooth to convolutely rugose, compressed to subquadrangular; achenes of the disk-florets sterile to (the outer) fertile, those of the ray-florets triquetrous to quadrangular, fertile.

KEY TO SPECIES, VARIETIES, AND FORMS OF GRINDELIA

- A. Upper portions of involueral bracts erect, ascending, horizontally spreading or slightly reflexed-squarrose..... B
- B. Pappus awns filiform or capillary, or, if subpaleaceous but appearing capillary in some Texan and New Mexican species, the free portion of the involueral bracts subcoriaceous and firm and much thickened; includes all Mexican species and two from Texas and New Mexico (refer to BB for exceptions)..... C
- C. Heads radiate..... D
- D. Leaves gradually reduced towards the heads, the heads not leafy-bracted; mature achenes longer than broad..... E
- E. Rays 17–22 mm. long.....6. *G. Nelsonii*
- EE. Rays 5–16 mm. long..... F
- F. Pappus awns serrulate to setulose..... G
- G. Upper and middle cauline leaves dentate to setulose or spinulose-denticulate; achenes smooth to striate or somewhat coarsely ribbed, 2.5–4 mm. long..... H
- H. Stems, at least in upper half, more or less pubescent; leaves mostly minutely puberulent on both surfaces.....
.....24. *G. scabra*
- HH. Stems glabrous throughout; leaves glabrous on both surfaces.....24a. *G. scabra* var. *neomexicana*

- GG. Upper and middle cauline leaves finely and closely crenulate;
 achenes conspicuously 9-10-costate with slender ribs, 2-2.3
 mm. long.....5. *G. grandiflora*
- FF. Pappus awns entire or subentire..... I
- I. Mature achenes smooth to slightly striate or shallowly
 rugulose or wrinkled..... J
- J. Stems and leaves glabrous; upper cauline leaves evenly and
 closely serrulate with setulose- or spinulose-tipped teeth.
28. *G. Greenei*
- JJ. Stems, at least towards heads, and leaves pubescent, often
 glandular; upper cauline leaves crenulate-serrulate to
 serrulate with broad to deltoid or slender obtuse to
 acuminate teeth K
- K. Rays 5-7 mm. long.....3. *G. Robinsonii*
- KK. Rays 8-16 mm. long..... L
- L. Stems predominantly glandular; involucral bracts al-
 ways glandular M
- M. Plant 5 dm. or more tall, corymbosely branched;
 involucral bracts green throughout.....
4. *G. Greenmanii*
- MM. Plant less than 5 dm. tall, mostly simple; involucral
 bracts more or less purplish.....
1a. *G. inuloides* var. *glandulosa*
- LL. Stems predominantly villosulous; involucral bracts
 glabrous or sparsely glandular..... N
- N. Leaves and bracts thinnish; involucral bracts
 slightly resinous, tips mostly flattened..... O
- O. Floriferous branchlets several, strict, uniformly
 foliose, sparsely villous and eglandular towards
 the heads; achenes slightly rugulose to finely
 verruculose.....9. *G. Palmeri*
- OO. Floriferous branchlets few, arcuate-ascending, mi-
 nutely bracteate and villous to hirtellous-gland-
 ular towards the heads; achenes smooth or
 slightly striate.....1. *G. inuloides*
- NN. Leaves and bracts firmly membranaceous to sub-
 coriaceous; involucral bracts conspicuously res-
 inous, tips subterete.....10. *G. subdecurrens*
- II. Mature achenes conspicuously and deeply rugose, or con-
 volutely-wrinkled, or finely rugulose-verruculose..... P
- P. Stems and leaves more or less pubescent..... Q
- Q. Floriferous branchlets densely foliose; achenes large,
 3.5-4.5 mm. long, conspicuously and deeply convolutely
 rugose-wrinkled.....2. *G. sublanuginosa*
- QQ. Floriferous branchlets not densely foliose; achenes small,
 1.8-2 mm. long, rugose-wrinkled.....7. *G. tenella*
- PP. Stems and leaves glabrous throughout..... R

- R. Disk in anthesis 0.7–1 cm. high, 0.8–1.6 cm. broad.....
14. *G. oxylepis*
- RR. Disk in anthesis smaller, 0.5–0.7 cm. high, 0.5–0.7 cm.
 broad.....14a. *G. oxylepis* f. *capitellata*
- DD. Leaves not reduced towards the heads, the heads conspicuously leafy-
 bracted; mature achenes as broad as or even broader than long..... S
- S. Stems, at least above, and leaves glandular-villosulous or glandular-
 hirtellous T
- T. Disk small, less than 2 cm. broad; pappus awns mostly dilated at
 apex; plants of Texas..... U
- U. Stem 2 dm. or more tall, conspicuously ramose; heads rather
 numerous.....8. *G. microcephala*
- UU. Stem less than 2 dm. tall, not conspicuously ramose; heads
 few.....8a. *G. microcephala* var. *pusilla*
- TT. Disk larger, 2 cm. or more broad; pappus awns not dilated at
 apex; plants of Mexico.....8d. *G. microcephala* var. *montana*
- SS. Stems and leaves eglandular..... V
- V. Margins of upper leaves narrowly setulose-denticulate, the base
 strongly amplified.....8b. *G. microcephala* var. *adenodonta*
- VV. Margins of upper leaves broadly crenulate-serrulate, the base
 less amplified....8c. *G. microcephala* var. *adenodonta* f. *angustior*
- CC. Heads discoid W
- W. Leaves commonly crenulate-serrulate, obtuse; involucre rather con-
 spicuously resinous, tips of bracts spreading to slightly reflexed-
 squarrose, subulate; mature achenes conspicuously and finely con-
 volutely-wrinkled.....14b. *G. oxylepis* var. *eligulata*
- WW. Leaves mostly subentire, acute; involucre scarcely resinous, tips of
 bracts erect and appressed, acute; mature achenes mostly smooth
29. *G. oolepis*
- BB. Pappus awns subpaleaceous to strongly paleaceous, or if appearing cap-
 illary, the species not from Mexico nor with rugose-wrinkled achenes;
 species of Western United States..... X
- X. Heads radiate..... Y
- Y. Free portion of involucre bracts 3 mm. or less long, acute to short
 subulate Z
- Z. Salt or brackish marsh species..... a
- a. Stems of season arising from ligneous axis up to a meter tall;
 upper leaves narrowed to base, slightly to not at all amplexicaul.. b
- b. Involucre bracts with mostly straight short appressed, ascend-
 ing or spreading tips, or the outer slightly reflexed..... c
- c. Stems of the season glabrous.....32. *G. humilis*
- cc. Stems of the season densely hirtellous-pubescent or villous
32b. *G. humilis* f. *pubescens*
- bb. Involucre bracts with tips more subulate and strongly re-
 flexed or recurved to revolute.....32a. *G. humilis* f. *reflexa*
- aa. Stems of season arising directly from crown of perennial tap-
 root, herbaceous throughout; upper leaves not narrowed to
 base, strongly amplexicaul or subamplexicaul.....33. *G. paludosa*

- ZZ. Species of the interior, or, if near the coast, not salt or brackish marsh types d
- d. Main cauline leaves pinnatifid or incised-dentate throughout 22. *G. laciniata*
- dd. Main cauline leaves entire, serrate or serrulate, dentate or denticulate, but never pinnatifid throughout e
- e. Leaves abundantly and conspicuously resinous-punctate throughout; stigmas linear to narrowly oblong-lanceolate f
- f. Stems 0.25–0.6 m. tall, slender, corymbosely branched above with divergently spreading to ascending floriferous branchlets g
- g. Stems several; upper leaves mostly oblong-lanceolate; lower and middle cauline leaves subamplexicaul 30. *G. Hallii*
- gg. Stems solitary; upper leaves mostly ovate-lanceolate; lower and middle cauline leaves distinctly amplexicaul 34c. *G. camporum* var. *abbreviata*
- ff. Stems 1.1–3 meters tall, stout, mostly paniculately much-branched with closely ascending and elongated floriferous branchlets h
- h. Leaves firm, presenting a resinous-lustrous appearance; achenes more than 4 mm. long; rays 16–18 34a. *G. camporum* var. *parviflora*
- hh. Leaves less firm, presenting a less resinous-lustrous appearance; achenes less than 4 mm. long; rays 32–44 31. *G. procera*
- ee. Leaves scarcely, if at all, resinous-punctate; stigmas broadly oblong or oblong-lanceolate i
- i. Mature achenes horizontally truncate at apex; rays 7–10.5 mm. long; species of the Colorado Plateau and adjacent region j
- j. Pappus awns 3.3–5 mm. long, acute to shortly acuminate k
- k. Main cauline leaves finely and remotely setulose-denticulate with fine short teeth scattered from base to apex 23. *G. arizonica*
- kk. Main cauline leaves sharply serrate or dentate with rather broad spinulose- or setulose-tipped teeth, remotely denticulate or serrulate about apex to entire l
- l. Main cauline leaves serrate or denticulate only towards apex, 5–8 times longer than broad 23a. *G. arizonica* var. *stenophylla*
- ll. Main cauline leaves serrate or dentate, usually throughout the entire length, $1\frac{3}{4}$ –4 times longer than broad 23b. *G. arizonica* var. *dentata*
- jj. Pappus awns 5–6.5 mm. long, attenuate-acuminate 23c. *G. arizonica* var. *microphylla*
- ii. Mature achenes bordered at apex with an undulate or unequal ridge, or 2–3-knobbed with short tooth-like projec-

- tions; rays 10–20 mm. long; species of the California coastal region m
- m. Stems mostly glabrous (rarely pubescent); leaves mostly glabrous; main middle and lower cauline leaves amplexicaul; pappus awns usually moderately to numerous serrulate n
- n. Stems glabrous.....43. *G. maritima*
- nn. Stems pubescent.....43a. *G. maritima* f. *anomala*
- mm. Stems mostly pubescent (sometimes glabrous in some varieties of *G. hirsutula*); leaves mostly puberulent or villosulous; main middle and lower cauline leaves mostly narrowed at the base (or in *G. hirsutula* subamplexicaul to amplexicaul); pappus awns usually entire or subentire... o
- o. Involucral bracts obviously graduate, the outer mostly shorter p
- p. Involucral bracts 4–6-seriate, not conspicuously crowded, with acute to short subulate tips; leaves not crowded on the stems..... q
- q. Outer and middle involucral bracts hirsutulous throughout, the outer 7–9 mm. long, loose with spreading or slightly recurved slender tips.....
.....42. *G. hirsutula*
- qq. Outer and middle involucral bracts glabrous to densely tomentose or hirsutulous, the outer 3–7 mm. long, mostly erect and appressed with short acute or short subulate tips..... r
- r. Stems, especially above the middle, more or less loosely crisp- or villous-pubescent..... s
- s. Involucral bracts glabrous to puberulent..... t
- t. Floriferous branchlets leafy near the head
.....42c. *G. hirsutula* var. *brevisquama*
- tt. Floriferous branchlets almost naked or bracteate near the head.....42f. *G. hirsutula* var. *brevisquama* f. *pedunculoides*
- ss. Involucral bracts densely hirsutulous to densely tomentulose
42e. *G. hirsutula* var. *brevisquama* f. *tomentulosa*
- rr. Stems glabrous to minutely puberulent..... u
- u. Stems mostly minutely puberulent; main cauline leaves entire to subentire.....
.....42h. *G. hirsutula* var. *subintegra*
- uu. Stems glabrous to glabrate; main cauline leaves denticulate to dentate or serrate..... v
- v. Leaves firmly membranaceous to submembranaceous, the main cauline remotely to closely dentate with slender to rather broad acute to acuminate teeth.....
42d. *G. hirsutula* var. *brevisquama* f. *glabrata*

- vv. Leaves firm and subcoriaceous, the main
cauline rather closely serrulate or den-
tulate with short sharply acute to sub-
spinulose-tipped teeth
.....42g. *G. hirsutula* var. *calva*
- pp. Involucral bracts 7-8-seriate, conspicuously crowded,
with short, subulate mostly recurved or reflexed
tips; leaves crowded.....42b. *G. hirsutula* f. *cacumena*
- oo. Involucral bracts not obviously graduate, the outer and
sometimes the middle equalling or surpassing the
height of the disk.....42a. *G. hirsutula* f. *patens*
- YY. Free portion of involucral bracts 3-10 mm. long, attenuate-filiform to
long-subulate x
- x. Leaves saliently and obtusely toothed..... y
- y. Stems minutely puberulent in part; leaves minutely scabridulous
in part; awns 4-7 mm. long, equalling length of disk-floret;
plants of western Texas and southeastern New Mexico.....
.....11. *G. Havardii*
- yy. Stems glabrous throughout; leaves glabrous throughout; awns
3-5 mm. long, $\frac{3}{4}$ - $\frac{7}{8}$ length of disk-floret; plants of Minnesota
and South Dakota south to Missouri, northern Texas, south-
eastern Wyoming, and introduced eastward and westward....
.....12. *G. squarrosa*
- xx. Leaves entire or with short salient acute or spinulose-tipped teeth.... z
- z. Pappus awns entire or subentire, at most remotely serrulate;
species not of salt marshes, sand beaches, or other coastal
habitats *
- * Pappus awns mostly $\frac{3}{4}$ to equalling length of disk-floret,
mostly 5-7 mm. long..... †
- † Involucral bracts horizontally spreading to slightly reflexed-
squarrose; achenes conspicuously 2-3-knobbed at apex or
equally undulately bordered or knobbed; species of Cali-
fornia §
- § Stems, leaves, and involucral bracts glabrous..... ¶
- ¶ Stems corymbosely much-branched above, bearing nu-
merous heads, usually white to stramineous; leaves
2-4 times longer than broad, the upper typically ovate
to broadly oblong-lanceolate, strongly amplexicaul..... x
- x Disk 1.1-2.5 cm. broad, 0.8-1.5 cm. high; rays 18-39,
the lamina 8-11 mm. long.....34. *G. camporum*
- xx Disk 0.7-1 cm. (up to 1.5 cm.) broad, 0.6-0.8 cm.
high; rays 16-18, the lamina 7-8 mm. long.....
.....34a. *G. camporum* var. *parviflora*
- ¶¶ Stems sparsely or remotely corymbosely branched, bear-
ing few heads, frequently purplish- or brownish-red;
leaves mostly 4-10 times longer than broad, the upper
typically linear-oblong to lanceolate, subamplexicaul
.....34d. *G. camporum* var. *Davyi*

- §§ Stems, at least in upper half, and often leaves and involueral bracts villous-pubescent to hirsutulous..... ⊕
- ⊕ Outer involueral bracts not conspicuously elongated and foliaceous.....34e. *G. camporum* var. *interioris*
- ⊕⊕ Outer involueral bracts much elongated, foliaceous...
.....34f. *G. camporum* var. *interioris* f. *foliacea*
- †† Involueral bracts erect, ascending or arcuate-ascending; achenes very slightly and mostly inconspicuously bordered at apex with slender margin or with 1-2 short projections at the angles, subtruncate; species not of California..... ≠
- ≠ Outer involueral bracts about equalling the height of the disk, the bracts appearing subequal; upper leaves mostly lanceolate-linear to lanceolate-oblong..... +
- + Leaves scarcely resinous, presenting a dull surface; serration of leaves, when present, of straight outwardly directed teeth; leaves on floriferous branchlets mostly 4-12 times longer than broad..... ⊖
- ⊖ Uppermost leaves linear to lanceolate-oblong, 4-12 times longer than broad, less than 2 cm. broad....
.....26. *G. lanceolata*
- ⊖⊖ Uppermost leaves ovate-lanceolate, 2½-3 times longer than broad, the larger cauline 2-2.8 cm. broad.....26a. *G. lanceolata* f. *latifolia*
- ++ Leaves moderately and conspicuously resinous-punctate; serration of leaves of closely appressed and incurved teeth; leaves on floriferous branchlets mostly 2½-4 times longer than broad.....27. *G. littoralis*
- ≠≠ Outer involueral bracts less than ½ the height of the disk, the bracts appearing more graduated; upper leaves ovate-lanceolate to ovate, conspicuously spinulose-serate.....25. *G. texana*
- ** Pappus awns mostly ½-⅔ length of disk-floret, mostly 3-4.5 mm. long #
- # Main middle and upper cauline leaves broadly ovate-lanceolate, strongly amplexicaul to subcordate, 2½-4 times longer than broad, those on floriferous branchlets ovate to oblong-lanceolate, strongly amplexicaul to subcordate, conspicuously subtending the heads..... <
- < Middle and upper leaves mostly entire; stems, at least above, glandular-villous, mostly densely pubescent throughout.....37. *G. integrifolia*
- << Middle and upper leaves coarsely dentate, those on floriferous branchlets dentate to subentire; stems mostly glabrous or sparsely villous, becoming glabrate in lower half, mostly non-glandular.....
.....37a. *G. integrifolia* f. *dentata*
- ## Main middle and upper cauline leaves linear-oblong to oblong-lanceolate, narrowed or the upper subamplexicaul,

- 5-10 times longer than broad, those on floriferous branchlets linear-oblong to lanceolate, subamplexicaul, not conspicuously subtending the heads..... \leq
 \leq Stems glabrous to glandular-puberulent, not villous.....
37b. *G. integrifolia* var. *virgata*
 \leq Stems more or less villous, more densely so towards heads
37c. *G. integrifolia* var. *virgata* f. *villosa*
- zz. Pappus awns numerous setulose to remotely serrulate, rarely entire; species in proximity of Pacific Ocean, mostly of salt marshes, sand beaches or other coastal habitats, or, if inland, on dry soils in the proximity of the ocean..... G
- G. Heads crowded in compact clusters, on short ascending mostly subracemose branchlets; leaves firm and subcoriaceous.
40. *G. aggregata*
- GG. Heads scattered on remotely to corymbosely branched branchlets; leaves fleshy, thin and submembranaceous to firmly membranaceous H
- H. Stems glabrous to sparsely pubescent towards heads; leaves (except for pubescence on margins) mostly glabrous on surfaces I
- I. Upper cauline leaves and those on and subtending floriferous branchlets mostly broader above the middle than at the base or of approximately the same breadth throughout, linear-oblong to oblanceolate-spatulate..... J
- J. Disk 1.6-2.5 cm. broad; rays 14-19 mm. long; plants of salt marshes, sand spits, or sand beaches..... K
- K. Leaf-surface mostly dull; involucre bracts slightly to moderately resinous..... L
- L. Stems erect, mostly 3-6 dm. tall..... M
- M. Main cauline leaves mostly 2-8 times longer than broad; heads subtended by the uppermost leaves, but these not crowded nor conspicuously elongated beneath the heads..... N
- N. Main cauline leaves oblanceolate or oblong-spatulate to lanceolate-oblong, 0.7-2 cm. broad, 5-8 times longer than broad.....
39. *G. stricta*
- NN. Main cauline leaves obovate-oblong, 1.5-3 cm. broad, 2½-4 times longer than broad.....
39a. *G. stricta* f. *venulosa*
- MM. Main cauline leaves mostly 10-15 times longer than broad; heads conspicuously subtended beneath by numerous elongated leaves.....
39c. *G. stricta* var. *Andersonii*
- LL. Stems procumbent to decumbent, subcaespitose, 1.5-3.5 dm. tall.....39b. *G. stricta* var. *procumbens*
- KK. Leaf-surface usually resinous-lustrous; involucre bracts more conspicuously and abundantly resinous
39d. *G. stricta* var. *aestuarina*

- JJ. Disk 1.1–2 cm. broad; rays 10–14 mm. long; plants of dry or rocky hillsides, slightly inland or on rocky banks or cliffs along sea-shore...39i. *G. stricta* var. *collina*
- II. Upper cauline leaves and those on and subtending floriferous branchlets mostly broader at the conspicuously amplified, subamplexicaul to cordate base than at the apex, pandurate-oblong, lanceolate to ovate or ovoid-oblong O
- O. Pappus awns entire to remotely serrulate; species of southern California north to Santa Cruz Co., and on Santa Barbara Islands, California..... P
- P. Heads conspicuously subtended by broadly ovoid-oblong to suborbicular-ovate leaves 1–3 cm. broad; main cauline leaves 3–8 cm. broad.....
.....44e. *G. rubricaulis* var. *latifolia*
- PP. Heads sometimes subtended by linear- to ovate-lanceolate, acute to acuminate leaves 0.2–1 cm. broad; main cauline leaves 0.7–3 cm. broad.....
.....44d. *G. rubricaulis* var. *robusta*
- OO. Pappus awns moderately to numerously serrulate to setulose; species of British Columbia and Puget Sound, Washington Q
- Q. Outermost involueral bracts mostly conspicuously more elongated than the others; bracts firmly membranaceous to subcoriaceous, the free upper portion usually thickened; achenes 4.5–5.2 mm. long.....
.....39e. *G. stricta* var. *aestuarina* f. *elongata*
- QQ. Outermost involueral bracts not more conspicuously elongated than the others; bracts thin and membranaceous, the free portion mostly thin and unthickened; achenes 5–7.5 mm. long.....
.....39f. *G. stricta* var. *macrophylla*
- HH. Stems loosely to densely villous to lanulose; leaves mostly sparsely hirsutulous to closely villosulous, the midrib usually more densely villous..... R
- R. Stems of season from branching aerial mostly elongated ligneous axes up to 2.5 dm. long, the herbaceous stems of season simple with one or few heads on unbranched or sparsely branched branchlets.....
.....39g. *G. stricta* var. *Hendersoni*
- RR. Stems of season arising directly or almost directly from the main caudex, the herbaceous stems of season mostly corymbosely to subcorymbosely branched with several floriferous branchlets.....39h. *G. stricta* var. *lanata*
- XX. Heads discoid S
- S. Upper and middle cauline leaves entire to remotely or closely crenulate-serrate to -denticulate; pappus awns remotely to moderately setulose-serrulate; mature achenes deeply ribbed or furrowed15. *G. aphanactis*

- SS. Upper and middle cauline leaves closely and evenly crenate or crenate-serrate, the teeth obtuse; pappus awns mostly entire; mature achenes smooth to slightly striated..... T
- T. Main cauline leaves oval to broadly oblong, mostly $1\frac{1}{2}$ –3 times longer than broad.....12b. *G. squarrosa* var. *nuda*
- TT. Main cauline leaves narrowly to broadly oblong or oblanceolate, mostly 4–10 times longer than broad.....
.....12c. *G. squarrosa* var. *nuda* f. *angustior*
- AA. Upper portions of involueral bracts revolute, strongly recurved or strongly reflexed-squarrose B
- B. Heads discoid C
- C. Mature achenes obliquely bordered at apex with 1–2 knobs or projections or the apex irregularly undulate; Pacific Coast species..... D
- D. Upper leaves $3\text{--}3\frac{1}{2}$ times longer than broad; pappus awns entire; species of southern California.....44c. *G. rubricaulis* var. *bracteosa*
- DD. Upper leaves 6–8 times longer than broad; pappus awns remotely to moderately serrulate to setulose-serrulate; species of Oregon, Washington, and Idaho.....38. *G. columbiana*
- CC. Mature achenes horizontally truncate at apex or with only semblance of shallow rim; species of the Colorado Plateau, intermontane basins, and southern Plains region..... E
- E. Disk at maturity deeply campanulate to campanulate-hemispherical, usually as high as or higher than broad; involueral bracts closely and strongly revolute in upper portion, the tips much thickened and subcoriaceous; perennials..... F
- F. Stems 0.5–1.5 m. tall, with very elongated fastigate floriferous branchlets; stigmas linear-lanceolate; leaves conspicuously resinous-punctate.....16. *G. fastigiata*
- FF. Stems 0.25–0.6 m. tall, with less elongated non-fastigate and more remote floriferous branchlets; stigmas oblong-lanceolate or oblong; leaves less conspicuously resinous-punctate..... G
- G. Main middle and upper cauline leaves ovate to broadly oblong, obtuse to obtusish, $1\frac{1}{2}$ –3 times longer than broad..17. *G. inornata*
- GG. Main middle and upper cauline leaves oblong to oblong-ob-lanceolate, acute to acutish, $3\frac{2}{3}$ –6 times longer than broad...
.....17a. *G. inornata* var. *angusta*
- EE. Disk at maturity mostly depressed- or campanulate-hemispherical, usually broader than high; involueral bracts mostly loosely or moderately reflexed-squarrose in upper portion, the tips only slightly thickened and less subcoriaceous; annuals to biennials..... H
- H. Upper and middle cauline leaves entire to crenulate-serrate or -denticulate; pappus awns serrulate to moderately setulose-serrulate; mature achenes deeply ribbed or furrowed...15. *G. aphanactis*
- HH. Upper and middle cauline leaves closely and evenly crenate or crenate-serrate with teeth obtuse; pappus awns usually entire or at most remotely serrulate; mature achenes smooth to slightly striate I

- I. Main cauline leaves oval to broadly oblong, mostly $1\frac{1}{2}$ –3 times longer than broad.....12b. *G. squarrosa* var. *nuda*
- II. Main cauline leaves narrowly to broadly oblong or oblanceolate, mostly 4–10 times longer than broad.....
.....12c. *G. squarrosa* var. *nuda* f. *angustior*
- BB. Heads radiate J
- J. At least the middle and upper leaves closely crenulate-serrate or crenulate, the teeth broadly obtuse and resiniferous; leaves grayish- or dark bluish-green K
- K. Upper and middle cauline leaves 2–4 times longer than broad, ovate-oblong, subpandurate or broadly oblong..... L
- L. Stems 0.4–1 m. tall.....12. *G. squarrosa*
- LL. Stems low and dwarfed, 0.1–0.25 m. tall...12a. *G. squarrosa* f. *depressa*
- KK. Upper and middle cauline leaves mostly 5–8 times longer than broad, linear-oblong or oblong to oblanceolate.....
.....12d. *G. squarrosa* var. *serrulata*
- JJ. Leaves variously dentate to serrulate, incised, or entire, but the teeth, when present, acute to acuminate; leaves dark, bright, drab, pale yellow or bright green..... M
- M. Heads crowded or agglomerated, forming a compactly arranged cluster on short ascending mostly subracemously branched floriferous branchlets.....40. *G. aggregata*
- MM. Heads obviously scattered on remotely to corymbosely branched floriferous branchlets N
- N. Pappus awns remotely serrulate to numerously setulose..... O
- O. Basal and lower leaves cuneate to broadly rhomboid-oblong, broadly obtuse to subtruncate at apex; middle cauline leaves often broadly obtuse or subtruncate..... P
- P. Stems of season arising from prostrate or spreading ligneous axes; lower and middle cauline leaves usually broadest above the middle; pappus awns moderately serrulate to numerously setulose-serrulate Q
- Q. Stems glabrous R
- R. Leaves firm to at most subcoriaceous; tips of involucrel bracts rather slender.....45. *G. arenicola*
- RR. Leaves thick and coriaceous; involucrel bracts more thickened.....45a. *G. arenicola* var. *pachyphylla*
- QQ. Stems villous or hirsute.....45b. *G. arenicola* f. *trichophora*
- PP. Stems of season arising directly from the abbreviated caudex; lower and middle cauline leaves usually of the same breadth throughout or broadest at the amplexicaul base; pappus awns entire to moderately serrulate.....
.....44h. *G. rubricaulis* var. *platyphylla*
- OO. Basal and lower leaves elliptic-oblong to oblanceolate-spatulate, acute to obtuse; middle cauline leaves mostly acute..... S
- S. Stems glabrous throughout; leaves glabrous..... T
- T. Stems of the season from elongated aerial basal ligneous

- axes or these sometimes wanting; rays 14–25 mm. long;
leaves fleshy to leathery-fleshy; maritime species..... U
- U. Stems of the season from elongated ligneous axes; leaves
very coriaceous-thickened; involueral bracts with the
upper portions strongly recurved or revolute; species
of Humboldt Bay Region, California.....41. *G. Blakei*
- UU. Stems of the season arising mostly from near or on the
substratum; leaves fleshy to firmly membranaceous; in-
volueral bracts with the upper portions slightly to mod-
erately recurved; species of southern Alaska south to
northern California V
- V. Leaf-surface mostly dull; involueral bracts slightly to
moderately resinous W
- W. Stems erect from an erect, ascending or slightly de-
cumbent base, mostly 2–6 dm. tall.....39. *G. stricta*
- WW. Stems procumbent to decumbent, subcaespitose from
a procumbent to prostrate base, 1.5–3.5 dm. tall....
.....39b. *G. stricta* var. *procumbens*
- VV. Leaf-surface often appearing resinous-lustrous; in-
volueral bracts more abundantly resinous.....
.....39d. *G. stricta* var. *aestuarina*
- TT. Stems of the season arising directly from the ground; rays
7–15 mm. long; leaves submembranaceous or firmly mem-
branaceous to subcoriaceous; interior species or if near the
coast, not of sand beaches, sand spits, or salt marshes..... X
- X. Interior species; mature achenes horizontally truncate at
apex, not 2–3-knobbed nor undulately bordered..... Y
- Y. Involuere and bracts slightly to moderately resinous..... Z
- Z. Leaves firmly membranaceous; involueral bracts with
the tips rather abruptly and closely recurved, firmly
membranaceous.....21. *G. decumbens*
- ZZ. Leaves submembranaceous; involueral bracts loosely
recurved, more membranaceous, more lax than in the
species.....21a. *G. decumbens* var. *subincisa*
- YY. Involuere and bracts abundantly and conspicuously
resinous a
- a. Pappus awns mostly 4–8, closely and numerous
setulose or setulose-serrulate; species of south-
eastern Wyoming and adjacent east-north-central
Colorado b
- b. Stems usually several from the base, subcaespitose,
slender; main cauline leaves 1.5–6 cm. long, the
upper cauline oblanceolate to lanceolate-oblong,
narrowed to the base.....20. *G. subalpina*
- bb. Stems usually one from the base, rather stout;
main cauline leaves 6–15 cm. long, upper cauline
oblong to ovoid, subamplexicaul.....
.....20a. *G. subalpina* var. *erecta*

- aa. Pappus awns mostly 2-4 (sometimes 5-8), only remotely or moderately serrulate or setulose-serrulate or numerous serrulate; species of Canada, Montana, the Dakotas, Minnesota, Utah, Idaho, northern and central Wyoming, central and southeastern Colorado, and northern New Mexico..... c
- c. Main middle and lower cauline leaves mostly 6-10 times longer than broad, the upper cauline usually at least 5 times longer than broad..... d
- d. Leaves closely and evenly crenulate-serrulate to closely serrulate, the radical and basal mostly not coarsely or irregularly incised-serrate or pinnatifid.....12d. *G. squarrosa* var. *serrulata*
- dd. Leaves characteristically entire to remotely serrulate, the radical and sometimes the middle cauline often becoming irregularly coarsely serrate or pinnatifid.....13. *G. perennis*
- cc. Main middle and lower cauline leaves mostly 2½-5 times longer than broad, the upper cauline at most 4 times longer than broad..... e
- e. Leaves subcoriaceous and thickened, entire to regularly rather remotely dentate or denticulate with short broad teeth.....18. *G. revoluta*
- ee. Leaves firmly membranaceous, saliently and sharply toothed with acute to setulose-acuminate teeth.....19. *G. acutifolia*
- XX. Coastal species of San Francisco Bay region; mature achenes bordered at apex with an undulate ridge, or 2-3-knobbed with short tooth-like projections...43. *G. maritima*
- SS. Stems villosulous to lanulose at least above; leaves sparsely hirsutulous to glabrous..... f
- f. Stems usually only sparsely or more densely pubescent in upper portion or near heads, otherwise glabrous; leaves mainly glabrous or glabrate..... g
- g. Upper leaves mostly broader above the middle, linear-oblong to oblanceolate-spatulate, usually narrowed to the base; achenes 3-5 mm. long..... h
- h. Leaves fleshy, slightly or inconspicuously resinous-punctate, the surface mostly dull; disk 1.6-2.5 cm. broad; rays 14-19 mm. long; salt-marsh, moist sand-spit, or sand-beach types.....39. *G. stricta*
- hh. Leaves more firmly membranaceous, more moderately or somewhat conspicuously resinous-punctate; disk averaging smaller, 1.1-2 cm. broad; rays 10-14 mm. long; plants of dry or rocky hillsides slightly inland, or rocky banks or cliffs near seashore.....
.....39i. *G. stricta* var. *collina*

- gg. Upper leaves mostly broader at base, pandurate-oblong to lanceolate, the base mostly conspicuously amplified, amplexicaul or subamplexicaul; achenes 5–7 mm. long
39f. *G. stricta* var. *macrophylla*
- ff. Stems mostly loosely or densely villous or lanulose throughout; leaves mostly sparsely hirsutulous to closely villosulous, the midrib usually more densely villous.....
39h. *G. stricta* var. *lanata*
- NN. Pappus awns mostly entire or at most remotely serrulate..... i
- i. Species of salt marshes..... j
- j. Stems of season arising from elongated aerial ligneous axes, the ligneous portions sometimes up to 1 m. tall; main middle and upper cauline leaves linear- to spatulate-oblong, mostly narrowed at base or only slightly broader at base than maximum breadth, 0.6–1.4 cm. broad, 4–7 times longer than broad.. k
- k. Entire plant 0.45–0.8 m. tall; aerial basal ligneous axes only 0.1–0.35 m. tall, the herbaceous stems of the season comprising most of the height; rays 24–45.....41. *G. Blakei*
- kk. Entire plant often 1–1.5 m. tall; aerial basal ligneous axes woody, up to 1 m. tall, usually comprising at least half or more of the total height of the plant; rays mostly 16–26 (up to 34).....32a. *G. humilis* f. *reflexa*
- jj. Stems of season arising directly from the caudex at the surface of the ground; main middle and upper cauline leaves broadly oblong to ovate, strongly amplexicaul, 1.5–4.5 cm. broad, 2½–4 times longer than broad.....33. *G. paludosa*
- ii. Species not of salt marshes..... l
- l. Main middle and lower cauline leaves conspicuously narrowed or attenuated to the base, mostly broadest about the middle or towards the apex; disk 0.6–2.2 cm. broad; plants of Montana, Idaho, Washington, Oregon, northern Nevada, and northern California m
- m. Heads campanulate-hemispherical, broader than high..... n
- n. Stems mostly slender and short, 2.5–6.5 dm. tall, the leaves of the floriferous branchlets reduced and scattered..... o
- o. Inner involucre bracts 7–10 mm. long, all with elongate tips 1.5–3 mm. long, these revolute for the upper ⅓ to ⅕ of the bract; plants of southern Washington, Oregon, and northern Nevada.....35. *G. nana*
- oo. Inner involucre bracts 5–7 mm. long, all with short tips 0.4–1.5 mm. long, these shortly and abruptly revolute for the upper ⅕ to ⅙ of the bract; plants of northern and central Washington and northern Idaho and Montana.....35f. *G. nana* var. *integerrima*
- nn. Stems stouter and taller, 3–11.5 dm. tall, the leaves of the floriferous branchlets not reduced and scattered up to heads (except in *G. nana* var. *altissima*)..... p

- p. Heads few; leaves of floriferous branchlets reduced and scattered; upper leaves with the base about as broad as the middle; plants of northern California and southwestern Oregon q
- q. Stems and leaves glabrous....35c. *G. nana* var. *altissima*
- qq. Stems and often leaves puberulent.....
.....35d. *G. nana* var. *altissima* f. *puberula*
- pp. Heads rather numerous; upper leaves not reduced and scattered up to the heads; upper cauline and those on floriferous branchlets conspicuously subamplexicaul; plants of Idaho, Montana, Washington, and Oregon... r
- r. Main cauline leaves mostly entire, elliptical-obovate to broadly oblong-ob lanceolate, mostly 1.5–2.3 cm. broad.....35g. *G. nana* var. *Paysonorum*
- rr. Main cauline leaves serrate to denticulate, oblanceolate to oblong-lanceolate, mostly 0.7–1.5 cm. broad
.....35a. *G. nana* f. *Brownii*
- mm. Heads turbinate, quadrate-hemispherical or deeply campanulate, higher than or as high as broad..... s
- s. Heads turbinate; floriferous branchlets fastigiately elongated; heads numerous; disk 0.65–1.1 cm. broad; main cauline leaves with a broad upper portion conspicuously attenuate to a subpetiolate base; plants of northern California and southwestern Oregon.....
.....35e. *G. nana* var. *turbinella*
- ss. Heads quadrate-hemispherical to deeply campanulate; floriferous branchlets conspicuously corymbosely elongated; heads few to moderate in number; disk mostly 1–2 cm. broad; main cauline leaves with the upper portion of about the same breadth or somewhat broader than the basal portion; plants of central Washington, western Montana, eastern Oregon, and Idaho.....
.....35b. *G. nana* f. *longisquama*
- ll. Main middle and lower cauline leaves about the same breadth at the base as at the middle or conspicuously broader at base, subamplexicaul to strongly amplexicaul; disk mostly 1.5–3.5 cm. broad (sometimes as small as 1.2 cm. broad); plants of southern and central California, and St. Maries River region, Idaho t
- t. Stigmas linear-lanceolate or narrowly linear; leaves conspicuously and abundantly resinous-lustrous; pappus awns $\frac{3}{4}$ to equalling length of disk-floret.....
.....34b. *G. camporum* var. *australis*
- tt. Stigmas oblong-lanceolate or oblong; leaves scarcely to moderately resinous-punctate, but the surface mostly dull; pappus awns usually $\frac{1}{2}$ to $\frac{2}{3}$ length of disk-floret (sometimes up to $\frac{3}{4}$ length)..... u

- u. Stems, at least above, and leaves glandular; achenes horizontally truncate at apex; plants of Idaho....36. *G. Howellii*
- uu. Stems and leaves eglandular; mature achenes bordered at the apex with broad projections; plants of the coast of southern and central California..... v
- v. Stems, at least above the middle, villous; leaves often villous or sparsely crisp-puberulent on both surfaces.... w
- w. Heads subtended by broadly deltoid-ovate or broadly ovate leaves 1-1.5 cm. broad; main middle and lower cauline leaves 3-4 cm. long, $1\frac{1}{2}$ - $2\frac{3}{4}$ times longer than broad, broadly ovate-oblong or ovate, subcordate to strongly amplexicaul.....
.....44g. *G. rubricaulis* var. *latifolia* f. *pubescens*
- ww. Heads subtended mostly by linear to oblong-lanceolate reduced leaves only 0.2-0.7 cm. broad; main middle and lower cauline leaves mostly 4-11 cm. (sometimes 3 cm.) long, 2-9 times longer than broad, linear- to obovate-oblong, narrowed to the subamplexicaul to amplexicaul base..... x
- x. Upper leaves linear-oblong to ovate-lanceolate, acute to acuminate, those on floriferous branchlets much reduced towards heads; main lower and middle cauline leaves 4-9 times longer than broad y
- y. Stems more or less villous above the middle; the upper leaves saliently dentate to entire, mostly sparsely villous or crisp-puberulent on both surfaces; main lower and middle cauline leaves $4-5\frac{1}{2}$ times longer than broad....44. *G. rubricaulis*
- yy. Stems mostly glabrous or sparingly villosulous; the upper leaves entire or denticulate, mostly glabrous or more or less villosulous; main lower and middle cauline leaves 6-9 times longer than broad.....44a. *G. rubricaulis* var. *permixta*
- xx. Upper leaves oblong to rhomboid, truncate to acute, those on floriferous branchlets mostly not reduced; main lower and middle cauline leaves mostly 2-3 times longer than broad.....
.....44i. *G. rubricaulis* var. *platyphylla* f. *villosa*
- vv. Stems more or less glabrous throughout; leaves glabrous (except for scabridulous margins)..... z
- z. Heads conspicuously subtended by broadly ovoid-oblong to suborbicular-ovate leaves 1-2.5 cm. broad; main cauline leaves 1.5-8 cm. broad..... ¶
- ¶ Main middle cauline leaves mostly 8-13 cm. long, 3-8 cm. broad; main cauline leaves usually remotely dentate, serrate or closely crenate-den-

- tate with short broad acute to obtuse teeth; stems stout, 5 or more dm. tall.....
44e. *G. rubricaulis* var. *latifolia*
- ¶ Main middle cauline leaves 3–4 cm. long, 1.5–2.5 cm. broad; main cauline leaves more sharply and saliently dentate or serrate with acute to spinulose teeth; stems more slender, mostly 4–4.5 cm. tall.....44f. *G. rubricaulis* var. *latifolia* f. *minor*
- zz. Heads sometimes subtended by linear- to ovate-lanceolate acute to acuminate leaves 0.2–1 cm. broad; main cauline leaves 0.7–1.8 cm. broad.....×
- × Stems with few or several floriferous branchlets bearing few to several heads; leaves on floriferous branchlets mostly not reduced; involucre bracts not conspicuously resinous; rays 12–17 mm. long.. ⊕
- ⊕ Leaves mostly thin and submembranaceous or firmly membranaceous; upper cauline and those on floriferous branchlets typically acute to acuminate.....44d. *G. rubricaulis* var. *robusta*
- ⊕ ⊕ Leaves mostly subcoriaceous; upper cauline and those on floriferous branchlets obtuse or obtusish.....44h. *G. rubricaulis* var. *platyphylla*
- ×× Stems with much-branched floriferous branchlets bearing usually numerous heads; leaves on floriferous branchlets reduced, becoming very small towards the heads; involucre bracts conspicuously resinous; rays mostly 8–12 mm. long.....
44b. *G. rubricaulis* var. *elata*

1. *G. inuloides* Willd. in Mag. Ges. Nat. Fr. Ber. 1: 261. 1807, not of most American authors; Willd. Enum. Pl. 2: 894. 1809; Ker in Bot. Reg. 3: pl. 248. 1817; Dunal in Mem. Mus. Par. 5: 50. pl. 5. 1819; Sweet, Hort. Brit. ed. 2. 298. 1830; DC. Prodr. 5: 315. 1836, as to synonymy and as to plant of *Humboldt & Bonpland*, not as to plants of *Berlandier 2186* nor *Berlandier 1542*, in large part as to description; Torr. & Gray, Fl. N. Am. 2: 247. 1842, as to synonymy and excluding β and γ , not as to plants of *Berlandier*, *Drummond*, *Nuttall*, and *Douglas*; Walp. Rep. Bot. Syst. 2: 958. 1843, in small part as to description; Loudon, Ladies' Fl. Gard. Orn. Per. 2: 25. pl. 55. 1844; Hemsl. Biol. Cent.-Am. Bot. 2: 112. 1881, as to *Bourgeau 515* and *Galeotti 2416* plants, not plants of *Parry & Palmer 371* nor *Berlandier 2186*; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as to synonymy chiefly, in small part as to description.

Inula serrata Pers. Syn. Pl. **2**: 451. 1807; Dunal in Mem. Mus. Par. **5**: 51. 1819, as synonym; Steud. Nom. Bot. **1**: 708. 1840, as synonym.

Inula spathulata Hort. Paris, ex Poir. Encyc. Suppl. **3**: 154. 1813.

Demetria spathulata Lag. Gen. & Sp. Nov. 30. 1816; Sweet, Hort. Brit. ed. 2. 298. 1830; Steud. Nom. Bot. **1**: 707. 1840, as synonym; Hemsl. Biol. Cent.-Am. Bot. **2**: 112. 1881, as synonym.

Aster spathulatus Hort. Roy. Madr. ex Lag. Gen. & Sp. Nov. 30. 1816, in synonymy, not *A. spathulatus* Lindl. nor *A. spathulatus* Hort. Cels. ex. Steud; Dunal in Mem. Mus. Par. **5**: 50. 1819, in synonymy; Lag. ex Nees, Gen. & Sp. Aster. 283. 1833, in synonymy; Hort. Madr. ex DC. Prodr. **5**: 315. 1836, in synonymy.

Grindelia angustifolia HBK. Nov. Gen. & Sp. **4**: 309. 1820, not DC. ex Dunal, 1819; Ker in Bot. Reg. **10**: pl. 781. 1824; Sweet, Hort. Brit. ed. 2. 298. 1830; Steud. Nom. Bot. **1**: 707. 1840, in synonymy; Loudon, Ladies' Fl. Gard. Orn. Per. **2**: 25. pl. 55. 1844; Hemsl. Biol. Cent.-Am. Bot. **2**: 112. 1881, in synonymy.

Grindelia spatulata Bernhardt ex Link, Enum. Pl. Hort. Berol. **2**: 336. 1821; Link ex Steud. Nom. Bot. **1**: 708. 1840, in synonymy.

Grindelia pubescens Nutt. in Jour. Acad. Phila. **7**: 74. 1834; Gray, Syn. Fl. N. Am. **1**²: 117. 1884, and ed. 2. 117. 1888, in synonymy.

Aster serratus Lag. ex DC. Prodr. **5**: 315. 1836, in synonymy, not *A. serratus* Thunb.; Steud. Nom. Bot. **1**: 157 and 707. 1840, in synonymy.

Aster spathularis Brouss. ex DC. Prodr. **5**: 315. 1836, in synonymy; HBK. Nov. Gen. & Sp. **4**: 309. 1820, in synonymy; Steud. Nom. Bot. **1**: 707. 1840, in synonymy.

G. arguta Schrad. ex DC. Prodr. **5**: 315. 1836; Steud. Nom. Bot. **1**: 707. 1840; Hemsl. Biol. Cent.-Am. Bot. **2**: 112. 1881, as to plant of *Humboldt & Bonpland*, not of *Wright*.

Donia inuloides Hook. Fl. Bor. Am. **2**: 25. [1834] 1840, in large part, excluding β (plant of *Douglas*).

Herbaceous, apparently biennial or perennial; stems one to several, erect, simple or branched with elongated subcorymbose branchlets bearing solitary terminal heads, greenish to rose-purplish, sparsely to densely villosulous, puberulent or mixed glandular-villosulous, often glabrate in the lower half, 2–4.5 dm. tall; leaves remote and bracteate towards heads, not resinous-punctate, grass- to yellowish-green, firmly membranaceous, closely and regularly serrulate with short or salient acute teeth, or subentire to entire towards heads, 0.5–5 cm. long, 0.2–1.5 cm. broad, mostly 2–5½ times longer than broad, the middle and upper linear-oblong to ovate-lanceolate or deltoid-ovate, acute to caudate, amplexicaul to subcordate, scabridulous, glandular-scabridulous or minutely glandular; disk depressed- to campanulate-hemispherical, 0.8–1.2 cm. high, 1.3–2.5 cm. broad; involucre (except the inner bracts) scarcely resinous, slightly graduate, the upper fourth to half free and spreading to slightly reflexed with short flattened tips, the bracts 3.5–10 mm. long, often green throughout, linear- to oblong-lanceolate with acuminate to caudate tips, glabrous or the outer sparsely puberulent or glandular-puberulent; rays 20–30, bright yellow or orange-yellow, lamina 11–16 mm. long, 3.2–4.3 mm. broad; achenes broadly oblong, 3–4 mm. long, 2–2.5 mm. broad, chestnut-brown, smooth or slightly striate, dull, compressed-subquadrangular, mostly subturgid, horizontally truncate at apex, the apicular portion narrow and inconspicuous as a shallow border; awns 2–4, nearly capillary, entire, 3–6.5 mm. long, about equalling or slightly less than length of disk-florets, straight.

Distribution: moist or semi-moist soil in upland meadows or slopes at altitudes of 7000–8000 ft., south-central Mexico, from Hidalgo to Oaxaca, west to Jalisco and Michoacan.

MEXICO: cultivated from Mexican seeds: “*Inula spatularis*, H.M. (Hortus monspeliensis acc. to Gray), 16” (G); Liverpool Garden, Oct. 9, 1820, herb. *Stead* (NY); “*Grindelia inuloides* (W)” (CAL fragment, and photograph of TYPE, CAL, G, M); MEXICO—Santa Fé sur les collines, Valleys de Mexico, July 5, 1865–1866, *Bourgeau* 515 (G); wet soil, Lecheria, alt. 7300 ft., Aug. 24, 1902, *Pringle* 9914 (G, M, NY, US); JALISCO—near Colotlan, Aug. 29, 1897, *Rose* 3608 (G, US); MICHOACAN—Punguato, vicinity of Morelia, alt. 1950 m., Aug. 25, 1910, *Arsène* 5823 (M, US); route de Mexico, vicinity of Morelia, alt. 1900 m., July 5, 1910, *Arsène* 5697 (G, M, US); prope Valladolid de Michoacan et Pazcuaro, *Humboldt & Bonpland* (M photograph of TYPE of *G. angustifolia*

H. & B.); QUERETARO—between Cadereyta and Visaron, Aug. 22, 1905, *J. N. Rose, Painter & J. S. Rose 9749* (G, US); HIDALGO—wet meadows, El Salto, alt. 7000 ft., July 25, 1898, *Pringle 6927* (CAL, G, M, MA, MU, NY, PO, R, US); OAXACA—Etla, June, 1888, *Seler & Seler 79* (US); between Coixtlahuaca and Tamazulapam, alt. 7000–7700 ft., Nov. 12, 1894, *E. W. Nelson 1945* (US).

1a. var. glandulosa (Greenman) Steyermark, comb. nov.

G. glandulosa Greenm. in Proc. Am. Acad. **34**: 575. 1899.

Stems with an ascending or slightly decumbent base, mostly several, simple or occasionally branched near the base, monocephalous, mostly densely glandular but also sparsely to densely villosulous; leaves densely mixed glandular-scabridulous; middle and inner bracts purplish or rose-purplish, mostly in upper half, the inner and sometimes the middle oblong with abruptly subulate or caudate tips, terminating more abruptly than in species, minutely glandular, bracts glandular-ciliate, the margins of the middle and outer somewhat suberose.

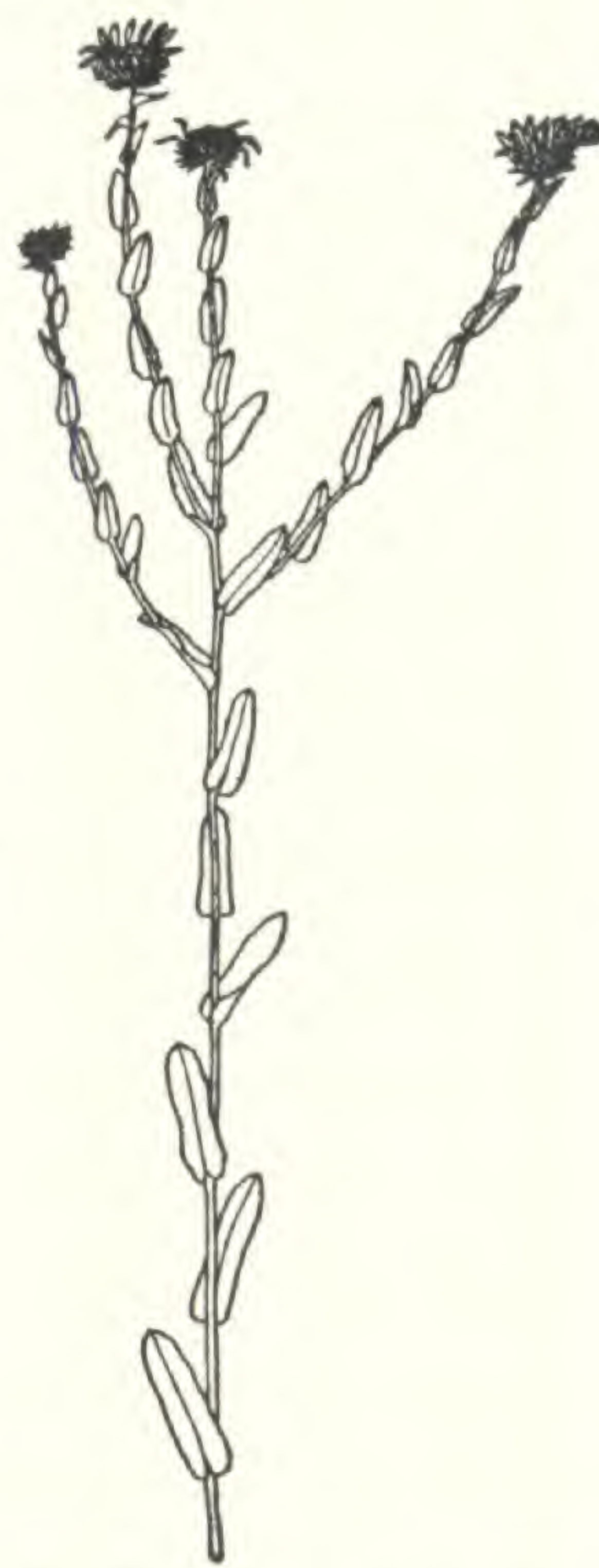
Distribution: on wet mountain meadows, southern Mexico.

MEXICO: HIDALGO—wet meadows, Sierra de Pachuca, alt. 10000 ft., Aug. 13, 1898, *Pringle 6962* (CAL, G TYPE, M, MA, MU, NY, PA, PO, US); wet meadows, Sierra de Pachuca, alt. 10000 ft., Aug. 23, 1902, *Pringle 9913* (G, M, NY, US); PUEBLA—meadows, Boca del Monte, Tehuacan, June, 1907, *Purpus 2466* (CAL, G).

The identity of *G. inuloides* Willd. has always been a source of confusion and has never been satisfactorily ascertained. In fact, the species has been so thoroughly misunderstood that it has served as a convenient catch-all for most Mexican and some Texan species. Most American authors have confused true *G. inuloides* Willd., a strictly central and southern Mexican species, with a common Texan entity, which proves to be a common but unnamed member of the *G. microcephala* DC. group, namely, *G. microcephala* var. *adenodonta* Steyermark.

The type of *G. inuloides*, of which I have seen a photograph and fragment, is represented by a single specimen in the Willdenow herbarium at Berlin, and is the only specimen labelled "*Grindelia inuloides*" both on the sheet and on a small label. This specimen, though representing but a fragmentary upper portion of a stem from the principal cauline axis, clearly shows the solitary terminal head and small leaves gradually reduced upwards and attenuate at apex; the leaves have margins with close sharp serrulations, also quite characteristic of this species. The fragment which Willdenow pre-

served in his herbarium under the name *G. inuloides*, and which must be taken as the type, was obtained from a plant cultivated in the Berlin Botanical Garden and raised from seed distributed by Professor Broussonet of Montpellier under the name *Aster spathularis*. Since Broussonet originally received these seeds from Sessé who sent them from somewhere "in Mexico," the original geographical source of the seed is obscure. However, it is known that Sessé collected on his trip with Mocino in southern Mexico, and passed north into the

Fig. 1. *G. inuloides*. $\times \frac{1}{5}$.Fig. 2. *G. sublanuginosa*. $\times \frac{1}{5}$.Fig. 3. *G. Robinsonii*. $\times \frac{1}{5}$.

Valley of Mexico and beyond. Collections which well match Willdenow's cultivated plant have been obtained from the states of Mexico, Michoacan, and southwards, from which geographical evidence it is clear that the seeds of Sessé's plant sent to Broussonet, and subsequently to Willdenow and others, were collected somewhere in this portion of southern or central Mexico.

Grindelia angustifolia HBK., not DC. ex Dunal, proves, upon examination of a photograph of the type preserved in the Herb. Museum d'Histoire Naturelle, to be synonymous with

G. inuloides Willd.; it is well matched by collections of *Arsène* 5697 and 5823 taken from the vicinity of Morelia, a region proximate to that where Humboldt and Bonpland collected their *G. angustifolia*. *Grindelia angustifolia* is a plant with somewhat shorter and narrower leaves and smaller heads than some other collections of *G. inuloides* Willd., but there are transitions from such narrower-leaved plants to those like *Pringle* 6927 and 9914 which have broader leaves and larger heads.

Nuttall's *Grindelia pubescens* is synonymous with *G. inuloides* and represents a luxuriant growth-phase of *G. inuloides*, a condition which may be due to cultivation or to more favorable growth factors. Such luxuriant plants of *G. inuloides* due to cultivation are represented by a specimen cultivated in the Liverpool Garden, Oct. 9, 1820, in Herb. Stead deposited in the Torrey Herbarium of the New York Botanical Garden, and by a specimen in Gray Herbarium cultivated as "*Inula spatularis*, in H. [ortus] M. [onspeliensis],⁵ 16" and represented in De Candolle's Herbarium in 1839. Nuttall's specimen was supposedly collected in "Arkansas," but certainly some confusion of locality data on the labels must have occurred in this instance, because *G. inuloides* is a strictly Mexican species, never having been collected either in Texas or much less "Arkansas," and the "Arkansas" data must therefore be cast aside as a probable error.

2. *G. sublanuginosa* Steyermark, sp. nov.⁶

Herbaceous; stems erect, much-branched above with spreading or irregularly ascending densely foliose floriferous branchlets, densely villous, 4 or more dm. tall; leaves olive-green, densely mixed glandular-puberulent, hirsutulous or sca-

⁵ The matter in brackets is supplied by the author.

⁶ *G. sublanuginosa* Steyermark, sp. nov., caulibus dense villosis, ramusculis patentibus vel irregulariter adscendentibus, dense foliosis; foliis dense glanduloso-puberulis, hirsutulis vel scabridiusculis, contiguae et regulariter serrulatis cum dentibus brevibus acutis, caulinis superioribus 2–3.5 cm. longis, 0.5–1.2 cm. latis, oblongo-lanceolatis vel ovatis, acutis vel acuminatis; bracteis involucri 3–4-seriatis, glabris; achaeniis oblongis, 3.5–4.5 mm. longis, 2–2.2 mm. latis, quadrangularibus, valde irregulariter rugosis.—Collected on south slope of hills fronting Lake Chapala, State of Jalisco, Mexico, January 5, 1903, *E. W. Nelson* 6523 (U. S. Nat. Herb. no. 399114 TYPE, NY isotype).

bridulous on both surfaces, densely villous at the base, closely and evenly serrulate with short acute teeth, the upper leaves 2–3.5 cm. long, 0.5–1.2 cm. broad, $2\frac{1}{2}$ –3 times longer than broad, oblong-lanceolate to ovate, acute to acuminate, amplexicaul to subamplexicaul; heads radiate, 1.7–2.5 cm. broad; disk small, campanulate-hemispherical, 0.8–1 cm. high, 1–1.5 cm. broad; involucre 3–4-seriate, the outer and middle bracts with the upper $\frac{1}{2}$ – $\frac{3}{4}$ free and spreading, or ascending portion 3.5–5 mm. long, flattened, lanceolate with long acuminate or subulate tips, 7–9 mm. long, firmly membranaceous, glabrous, outermost ones glandular-puberulent; rays 8–21, bright yellow or orange-yellow, the lamina 9–11 mm. long; achenes oblong, 3.5–4.5 mm. long, 2–2.2 mm. broad, quadrangular, buff to light brown, conspicuously irregularly wrinkled with rather large convolutions, horizontally truncate at apex; awns 4, capillary-linear, entire, 3.5–4.5 mm. long, equalling length of disk-floret.

Distribution: hills around Lake Chapala, State of Jalisco, west-central Mexico.

MEXICO: JALISCO—south slope of hills fronting Lake Chapala, Jan. 5, 1903, *E. W. Nelson 6523* (NY, US TYPE).

The distinctly tetragonal achenes, deeply and conspicuously rugose-convoluted on all faces, mark this species from all other Mexican ones. The development of a dense villous pubescence on the stems and around the bases of the leaf blades is also much more pronounced than in any other Mexican species.

3. *G. Robinsonii* Steyermark, sp. nov.⁷

Herbaceous; stems slender, mostly solitary, remotely and irregularly branched above with elongated arcuate-ascending or spreading monocephalous floriferous branchlets, buff to

⁷ *G. Robinsonii* Steyermark, sp. nov., caule tenui, plerumque 1, supra remote et irregulariter ramoso cum ramusculis floriferis tenuibus elongatis arcuato-ascendentibus vel patentibus, parce vel moderatim villosis, 1.5–4 dm. altis; foliis adversum capitula gradatim reductis, contigue et regulariter serrulatis cum dentibus brevibus deltoideis acutis vel acuminatis, 1–5 cm. longis, 0.3–1.3 cm. latis, 1–5 plo longioribus quam latis, oblongo- vel oblanceolato-spathulatis, illis in ramusculis floriferis ovato-oblongis vel oblongo-lanceolatis, moderatim scabridulo-hirsutulis; capitulis paucibus, 1.6–2.2 cm. latis; disco 0.7–1 cm. alto, 1–1.6 cm. lato; bracteis involucri 3–6.5 mm. longis, lineari- vel late oblongo-lanceolatis cum apicibus brevibus acutis vel acuminatis; receptaculo parce foveolato; ligulis 15–20, 5–7 mm. longis, 1.5–2 mm. latis; achaeniis paullum rugulosis.—Collected at Agua del Medio, San Luis Potosi, Mexico, July, 1911, *Purpus 5722* (U. S. Nat. Herb. no. 464079 TYPE, G, M, NY, isotypes).

purplish-red, sparsely or moderately villous to villosulous, 1.5–4 dm. tall; leaves gradually reduced towards heads, scarcely resinous-punctate, rather subcoriaceous, closely crenate-serrate to regularly serrulate with short deltoid acute to acuminate teeth, 1–5 cm. long, 0.3–1.3 cm. broad, 1–5 times longer than broad, oblong to oblanceolate-spatulate, obtuse to obtusish, subamplexicaul or about as broad at the base as at the middle, those on floriferous branchlets ovate-oblong to oblong-lanceolate, obtuse to acute, amplexicaul or subamplexicaul, moderately scabridulous-hirsutulous; heads few, radiate, 1.6–2.2 cm. broad; disk campanulate-hemispherical, 0.7–1 cm. high, 1–1.6 cm. broad; involucral bracts about 4-seriate, 3–6.5 mm. long, linear- to broadly oblong-lanceolate with acute to acuminate short tips, the outer and middle apparently not resinous, the outer sparsely puberulous to glabrate, the others mostly glabrous; rays 15–20, dull yellow, lamina 5–7 mm. long; achenes broadly oblong or quadrate-oblong, light brown, turgid, compressed-subquadrangular, 2.5–2.6 mm. long, 1.5–1.7 mm. broad, slightly wrinkled when mature, horizontally truncate at apex; awns 2, nearly capillary, entire, 4–4.5 mm. long, equalling the length of disk-floret.

Distribution: State of San Luis Potosi, central Mexico.

MEXICO: SAN LUIS POTOSI—Minas de San Rafael, July, 1911, *Purpus* 5151 (CAL, G); Agua del Medio, July, 1911, *Purpus* 5722 (G, M, NY, US TYPE).

4. *G. Greenmanii* Steyermark, sp. nov.⁸

G. inuloides Willd. acc. to Wats. in Proc. Am. Acad. **18**: 101. 1883, as to plant of *Palmer* 471.

Herbaceous; stem with several erect-ascending corymbosely

⁸ *G. Greenmanii* Steyermark, sp. nov., caulibus corymboso-ramosis, glanduloso-puberulis, ramusculis floriferis dense glandulosis, elongatis, 5 dm. vel plus altis; foliis non bracteatis adversum capitula, firme membranaceis, illis in ramusculis floriferis regulariter et tenuiter denticulatis aut denticulato-serrulatis cum dentibus tenuibus setulosis, glanduloso-puberulis, elongatis, plerumque 2–7 cm. longis, capitula terminalia solitaria ferentibus; capitulis radiatis, 3.5–4 cm. latis; disco 1.2–1.4 cm. alto, 2.2–2.5 cm. lato; bracteis involucri patentibus vel adscendentibus, 8–11 mm. longis, exterioribus 8–9 mm. longis, submembranaceis, tenuibus, minute glandulosis; ligulis 12–16 mm. longis; achaeniis oblongis, 2.5–3 mm. longis, 1.5–1.7 mm. latis, parte exteriori convexa paullum rugulosa, ceteribus laevibus; aristis 5–7 mm. longis.—Collected at Lerios, State of Coahuila, Mexico, July 10–13, 1880, *Ed. Palmer* 471 (Gray Herb. TYPE, PA, US, isotypes).

branched elongated monocephalous floriferous branchlets, brown or cinnamon, mixed glandular-puberulent, densely glandular, especially on floriferous branchlets, at least 5 dm. tall; leaves slightly reduced towards heads, scarcely resinous-punctate, firmly membranaceous, the upper regularly finely denticulate or serrulate with setulose acute teeth, 2–7 cm. long, 0.5–1.2 cm. broad, 3–6 times longer than broad, oblong-lanceolate to lanceolate, acuminate, subamplexicaul to amplexicaul, mixed densely glandular and puberulent; heads radiate, 3.5–4 cm. broad; disk depressed- or campanulate-hemispherical, 1.2–1.4 cm. high, 2.2–2.5 cm. broad; involucral bracts scarcely resinous, about 4-seriate, the upper half free and spreading to ascending, 8–11 mm. long, mostly linear to lanceolate with elongated subulate tips, minutely glandular; rays about 25, lamina 12–16 mm. long; achenes oblong, 2.5–3 mm. long, 1.5–1.7 mm. broad, compressed-subquadrangular or somewhat flattened, dull or dark brown, slightly roughened on convex outer portion, smooth on inner and lateral faces, horizontally truncate at apex; awns 2–3, nearly capillary, 5–7 mm. long, entire, equalling length of disk-floret.

Distribution: mountainous region about Lerios, southeastern portion of State of Coahuila, northeastern Mexico.

MEXICO: COAHUILA—Lerios, 15 leagues east of Saltillo, July 10–13, 1880, *Ed. Palmer 471* (G TYPE, PA, US).

5. *G. grandiflora* Hook. Bot. Mag. III. 8: *pl.* 4628. 1852, not of most American authors; Lindl. & Paxt. ex Paxt. Fl. Gard. 3: 8. 1852–53; Walp. Ann. 5: 191. 1858; Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as name-bringing synonym; Small, Fl. Southeast. U. S. 1180. 1903, and ed. 2. 1180. 1913, as to name only.

G. squarrosa var. *grandiflora* (Hook.) Gray, Smithson. Inst. Contr. [Pl. Wright. pt. 1] 3⁵: 98. 1852, as to name-bearing synonym only; Coult. in Contr. U. S. Nat. Herb. [Bot. W. Texas] 2: 184. 1892, as to name-bearing synonym only.

G. costata Gray in Proc. Am. Acad. 17: 208. 1882; Wats. in Proc. Am. Acad. 18: 102. 1883; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888; Hemsl. Biol. Cent.-Am. Bot. 4: 52. 1886.

Herbaceous biennial or annual; stems corymbosely much-branched above the middle with elongated simple monocephalous branches, glabrous, up to 1 m. tall; leaves somewhat reduced on flower-bearing branches, submembranaceous, dull green, not obviously resinous-punctate, finely and evenly crenulate, the upper sometimes entire, the basal cauline mostly lyrate

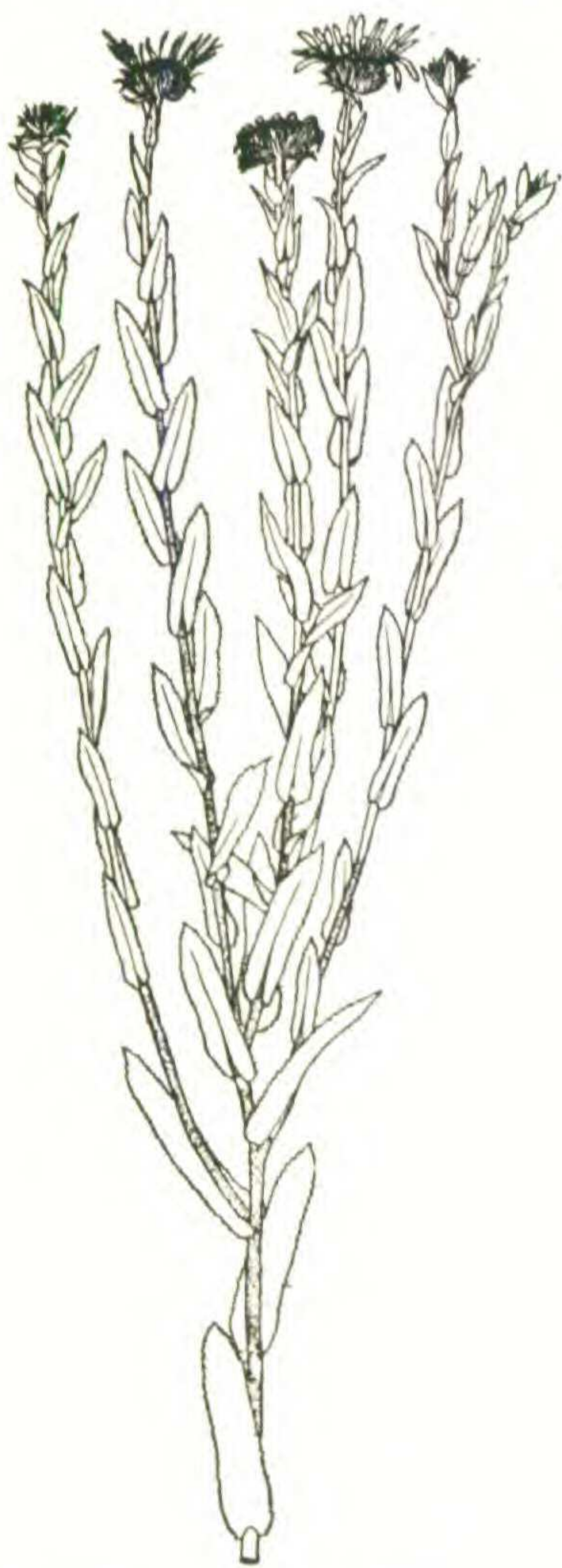


Fig. 4. *G. Greenmanii*. $\times \frac{1}{5}$.



Fig. 5. *G. grandiflora*. $\times \frac{1}{5}$.

or pinnatifid, acute to acuminate, linear to lanceolate-oblong, the upper lanceolate, the middle and upper cauline 4–6 cm. long, 0.8–1.5 cm. broad, those on the floriferous branches smaller, 1–3 cm. long, 3–7 mm. broad, 4–6 times as long as broad, sub-amplexicaul, glabrous; heads radiate, about 2.5 cm. broad; disk depressed-hemispherical, 10–14 mm. broad, 6–8 mm. high; involueral bracts 4–7.5 mm. long, linear to lanceolate, with

loose spreading to ascending filiform-subulate tips, submembranaceous, the free portion subterete, glabrous, innermost possessing some viscidiness when young; receptacle inconspicuously foveolate; rays orange-yellow or golden, 17–26, the lamina 10–12 mm. long; achenes broadly oblong, 2–2.3 mm. long, 1.8–2 mm. broad, turgid, convexly rounded on the dorsal ends, brownish or stramineous, conspicuously costate with 9–10 ribs, 7–8 prominent and 2–3 smaller, obliquely truncate at apex; awns 2–4, nearly capillary, slightly dilated at the acute apex, remotely to numerously serrulate or setulose-serrulate, 3–4.5 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: along river courses in arid rocky southwestern Texas in Valverde, Sutton, and Edwards Counties, to northern Coahuila, Mexico.

UNITED STATES: TEXAS—Ranch Experiment Station, Edwards Co., Oct. 6, 1932, *Cory 5013* (CO); 14 miles south of Sonora, Sutton Co., Sept. 16, 1932, *Cory 4896* (CO); cult. in Hort. Kew. from seeds collected in Texas by *Wright* (M photograph of TYPE); along Devil's River, Valverde Co., Sept. 13, 1900, *Eggert* (M); between the head of the San Pedro River and Live Oak Creek, Nov., 1851, *Schott 514* (F, G, NY).

MEXICO: Coahuila and Nuevo Leon, Feb.–Oct., 1880, *Ed. Palmer 472* (G TYPE of *G. costata*, PA, US).

An examination of the photograph of the type of *G. grandiflora* Hook. shows that it is not the plant which most American authors have identified as *G. grandiflora* (that proving rather to be *G. texana* Scheele), but that it is the rare species of southwestern Texas and adjacent northern Mexico which Gray described as *G. costata*. The conspicuously ribbed achenes of this species are very characteristic. The lamina of the ray-flowers are almost orange, quite different from the lemon-yellow color of most species of *Grindelia*.

6. *G. Nelsonii* Steyermark, sp. nov.⁹

Herbaceous; stems corymbosely branched above with elongated ascending floriferous branchlets, rose-purple to buff,

⁹ *G. Nelsonii* Steyermark, sp. nov., caulibus glabris vel parce puberulis; foliis firme membranaceis, atro-viridibus, contiguae et regulariter crenulato-serrulatis cum dentibus latis acutis, 1–7.5 cm. longis, 0.3–1.2 cm. latis, $2\frac{1}{2}$ –7 plo longioribus quam latis, linearibus vel lineari-oblongis, vel (superioribus) ovato-lanceolatis; ligulis 26–30, elongatissimis, 17–22 mm. longis; achaeniis laevibus vel paullum striatis.—Collected at Los Reyes, Michoacan, Mexico, Feb. 8–12, 1903, *E. W. Nelson 6864* (U. S. Nat. Herb. no. 399215 TYPE, G, NY, isotypes).

glabrous to sparsely puberulent; leaves firmly membranaceous, scarcely resinous-punctate, dark green, becoming reduced and scattered towards the heads, closely crenulate-serrulate with shallow inconspicuous broad acute or slender obtuse teeth, 1–7.5 cm. long, 0.3–1.2 cm. broad, $2\frac{1}{2}$ –7 times longer than broad, linear or linear-oblong to (the upper) ovate-lanceolate, acute to acuminate, the upper subamplexicaul, glabrate to puberulent; heads radiate, 3–5 cm. broad; disk campanulate-hemispherical, 0.9–1.3 cm. high, 1.5–2.5 cm. broad; involucral bracts moderately resinous, 4-seriate, the upper $\frac{1}{3}$ – $\frac{1}{4}$ free and spreading, 4–8 mm. long, lanceolate with acute to acuminate tips, the free portion flattened, subcoriaceous or firmly membranaceous, glabrous; receptacle moderately foveolate; rays 26–30, conspicuously elongated, orange-yellow, the lamina 17–22 mm. long, 3–3.5 mm. broad; achenes broadly oblong, subquadrangular, turgid, 3–4 mm. long, 2–2.3 mm. broad, smooth or slightly striate, light yellow or tawny brown, apex truncate, rounded and slightly thickened at the angles; awns 2–3, capillary-linear, entire, acute, 4–4.5 mm. long, about equalling length of disk-floret.

Distribution: Los Reyes, Michoacan, west-central Mexico.

MEXICO: MICHOACAN—Los Reyes, Feb. 8–12, 1903, *E. W. Nelson 6864* (G, NY, US TYPE).

7. *G. tenella* Steyermark, sp. nov.¹⁰

G. inuloides Willd. acc. to DC. Prodr. 5: 315. 1836, as to plant of *Berlandier 766 (2186)*; acc. to Hemsl. Biol. Cent.-Am. Bot. 2: 112. 1881, as to plant of *Berlandier 766 (2186)*.

G. inuloides Willd. var. *microcephala* Gray acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as to plant from Mexico of *Berlandier 766 (2186)*.

¹⁰ *G. tenella* Steyermark, sp. nov., ramusculis floriferis adscendentibus capitula terminalia ferentibus, supra parce vel dense villosis vel villosiusculis; foliis capitula non subtendentibus, contigue et regulariter denticulatis vel denticulato-serrulatis cum dentibus setulosis oblongis resiniferis, oblanceolato-oblongis aut oblongis vel lanceolatis, plus minusve villosiusculis vel hirtellis; disco 0.6–0.9 cm. alto, 0.9–1.3 cm. lato; achaeniis quadrato-oblongis, subquadrangularibus, 1.8–2 mm. longis, 1–1.8 mm. latis, rugosis; aristis 2, integris, acutis.—Collected from Victoria to Tula, State of Tamaulipas, Mexico, Nov., 1830, *Berlandier 766 (2186)* (Gray Herb. TYPE, NY isotype).

Herbaceous; stems slender, cinnamon-buff to bay, branched with long ascending floriferous branchlets, bearing mostly solitary small terminal heads, glabrous or glabrate below, sparsely to densely villous or villosulous above, at least 4 or more dm. tall; leaves only slightly reduced on floriferous branchlets, scarcely resinous-punctate, submembranaceous to firmly membranaceous, dark green, regularly denticulate to denticulate-serrulate with fine shallow to mostly salient setu-

Fig. 6. *G. Nelsonii*. $\times \frac{1}{5}$.Fig. 7. *G. tenella*. $\times \frac{1}{5}$.Fig. 8. *G. Palmeri*. $\times \frac{1}{5}$.

lose or oblong, acute or obtuse, resin-tipped teeth up to 1.5 mm. long, 1.5–5 cm. long, 0.5–1.1 cm. broad, oblanceolate-oblong or oblong to lanceolate, obtuse to acute, subamplexicaul, or about as broad at base as at middle, rather closely villosulous or hirtellous; heads radiate, 2–2.5 cm. broad; disk campanulate-hemispherical, 0.6–0.9 cm. high, 0.9–1.3 cm. broad; involucral bracts scarcely resinous, 3.5–6.5 mm. long, linear- to lanceolate-subulate with elongated subulate tips, upper $\frac{1}{2}$ – $\frac{2}{3}$ free and arcuate-spreading or ascending, subterete, firmly membranaceous, sparsely puberulent to glabrate; rays 15–18, lamina 7–9

mm. long, 2–3 mm. broad; achenes quadrate-oblong, subtergic, subquadrangular, chestnut-brown, dull, 1.8–2 mm. long, 1–1.8 mm. broad, rugose, horizontally truncate at apex; awns 2, capillary-linear, entire, acute, 4–5 mm. long, equalling length of disk-floret.

Distribution: mountain slopes, States of Nuevo Leon and Tamaulipas, north-eastern Mexico.

MEXICO: TAMAULIPAS—pré la cuesta circa Victoria, de Victoria a Tula, Nov., 1830, *Berlandier* 766 (2186) (G TYPE, NY); on mountain side, south of Victoria, alt. 900 m., March 24, 1925, *Runyon* 725 (US); NUEVO LEON—Monterrey, Fundicion, alt. 540 m., July, 1911, *Arsène & Abbon* 101 (G, M, US).

8. *G. microcephala* DC. Prodr. 5: 315. 1836, not *G. microcephala* Rothr.; Torr. & Gray, Fl. N. Am. 2: 247. 1842, as synonym; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as synonym; Small, Fl. Southeast. U. S. 1180. 1903, and ed. 2. 1180. 1913.

G. inuloides γ Torr. & Gray, Fl. N. Am. 2: 247. 1842.

G. inuloides var. *microcephala* Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, excluding plant of *Palmer* 469; Wats. in Proc. Am. Acad. 18: 101. 1883, as to plant of *Palmer* 2078 only; Coult. in Contr. U. S. Nat. Herb. [Bot. W. Texas] 2: 184. 1892.

Stems slender and conspicuously branched from base to apex, mixed glandular-villosulous, the villosulous hairs predominating, 2.5–4 dm. tall; the main cauline leaves and those on floriferous branchlets 0.8–3 cm. long, 0.7–1.5 cm. broad, 1 $\frac{1}{3}$ –3 $\frac{1}{2}$ times longer than broad, often mixed glandular-hirtellous, the main middle and upper cauline narrowly to broadly oblong, about as broad at base as at the middle, not conspicuously amplified, obtuse to acutish, those on floriferous branchlets broadly ovate-oblong, about as broad at base as at middle, or amplified, middle and upper leaves closely and evenly crenulate-serrulate or crenulate-denticulate with conspicuous rather setulose obtuse teeth; heads numerous, disk 0.6–0.9 cm. high, 0.8–1.3 cm. broad; achenes smoothish to slightly wrinkled on faces, the angles thickened, dark brown, the faces sometimes longitudinally ribbed or thickened; awns dilated at apex, nearly capillary, straight.

Distribution: coastal region of south-central Texas in vicinity of Corpus Christi and Rio Frio.

TEXAS: Corpus Christi, Sept., 1879–Oct., 1880, *Ed. Palmer 2078* (G); about Corpus Christi, Nueces Co., sea-level to 40 ft. alt., June 2–6, 1894, *Heller 1820* (CAL, G, M, MA, MU, NY, PA, US); in campis prope Rio Frio, Juli, 1829, and Juli, 1828, *Berlandier 647 (2057)* (G TYPE, M, NY); clay soil, near Corpus Christi, Nueces Co., April 25, 1930, *Warren 1210* (B).

8a. var. pusilla Steyermark, var. nov.¹¹

G. inuloides var. *microcephala* Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, only as to plant of *Palmer 469*; Wats. in Proc. Am. Acad. 18: 101. 1883, as to plant of *Palmer 469* only.

Stems erect to spreading, mixed glandular and villosulous, 0.35–1.9 dm. tall, the heads terminating simple short or sparingly branched stems; leaves small, 1.2–4.5 cm. long, 0.2–1 cm. broad, evenly crenulate-serrulate or denticulate with short shallow mostly obtuse teeth, oblong to oblong-lanceolate, obtuse to acute, mixed glandular and hirtellous; disk small, 0.6–0.9 cm. high, 0.5–1.3 cm. broad; involucral bracts shorter than var. *adenodonta*, with shorter acute to short subulate tips.

Distribution: coastal region of southwestern Texas.

TEXAS: Spofford, May 8–9, 1904, *Griffiths 6302* (US); dry open ground, Cotulla, LaSalle Co., March 16, 1917, *E. J. Palmer 11295* (G, M); between the Frio and the Nueces Rivers, on the road to Laredo, Jan. 27–28, 1880, *Ed. Palmer 469* (G TYPE, M, NY, US).

8b. var. adenodonta Steyermark, var. nov.¹²

G. inuloides of most authors, in large part, not Willd.; DC. Prodr. 5: 315. 1836, as to plants from Texas of *Berlandier*

¹¹ *G. microcephala* var. *pusilla* Steyermark, var. nov., caulibus 0.35–1.9 dm. altis; foliis 1.2–4.5 cm. longis, 0.2–1 cm. latis, oblongis vel oblongo-lanceolatis; disco 0.6–0.9 cm. alto, 0.5–1.3 cm. lato; bracteis involucri brevioribus, apicibus brevioribus quam in *G. microcephala* var. *adenodonta*.—Collected on the road to Laredo between the Frio and the Nueces Rivers, Texas, January 27–28, 1880, *Ed. Palmer 469* (Gray Herb. TYPE, M, NY, US, isotypes).

¹² *G. microcephala* var. *adenodonta* Steyermark, var. nov., caulibus supra moderate vel dense hirtellis vel villosiusculis, eglandulosis, 0.35–1.3 m. altis; foliis capitula valde subtendentibus, superioribus regulariter et tenuiter denticulatis, pectinato- vel serrulato- vel crenulato-denticulatis cum dentibus salienter setulosis, resiniferis, 2–5 cm. longis, 0.6–2.5 cm. latis, subpandurato-oblongis vel oblongo- vel ovato-lanceolatis, inferioribus et mediis late ligulato-oblongis; achaeniis depresso-rhomboideis, rugosis, 3–4.3 mm. longis.—Collected 39 miles west of San Felipe, Texas, July–Aug., 1844, *Lindheimer 255* (Mo. Bot. Gard. Herb. no. 130145 TYPE, CAL, G, PA, isotypes).

1542; Hook. Bot. Mag. N. S. **13**: pl. 3737. 1840; acc. to Gray, Syn. Fl. N. Am. **1**²: 117. 1884, and ed. 2. 117. 1888, as to plants from Texas (*Lindheimer* 255, *Drummond* 131, and *Reverchon*); Coult. in Contr. U. S. Nat. Herb. [Bot. W. Texas] **2**: 184. 1892; acc. to Small, Fl. Southeast. U. S. 1180. 1903, and ed. 2. 1180. 1913.

Stems stoutish, usually one from an herbaceous base, corymbosely branched above with several conspicuously elongated

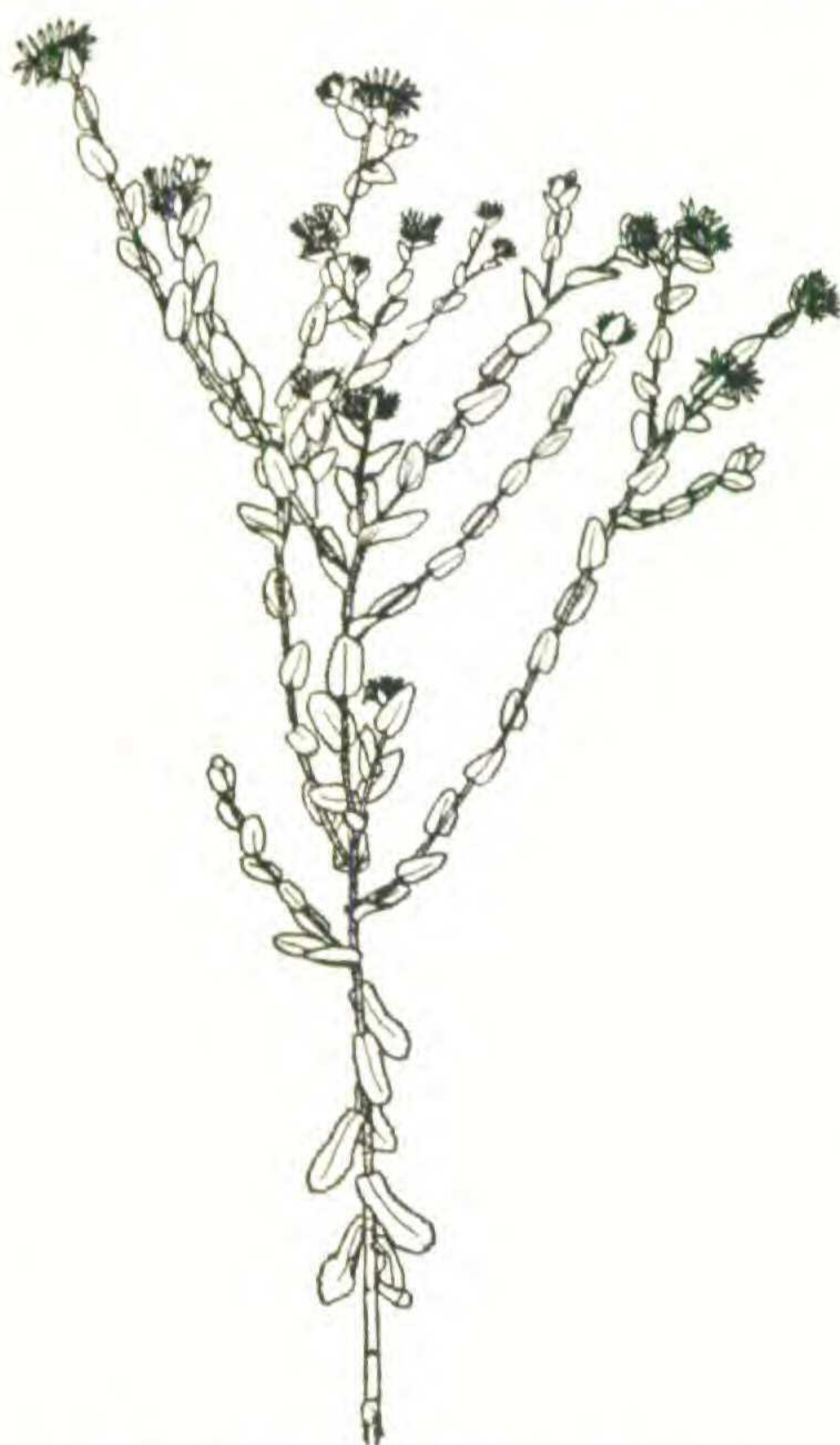


Fig. 9. *G. microcephala*. $\times \frac{1}{5}$.



Fig. 10. *G. subdecurrens*. $\times \frac{1}{5}$.

floriferous branchlets bearing several heads, stramineous to Indian-purple, sparsely hirtellous to glabrate below, moderately to densely hirtellous to villosulous above, eglandular, 0.35–1.3 m. tall; leaves not reduced, subtending the heads, the upper and often the middle cauline very evenly and finely denticulate with short conspicuous setulose resin-tipped teeth, the upper cauline and those on floriferous branchlets 2–5 cm. long, 0.6–2.5 cm. broad, $1\frac{1}{3}$ – $3\frac{3}{4}$ times longer than broad, the lower and middle cauline 4.5–9 cm. long, 1.5–3 cm. broad, 3–4 times longer than broad, middle and upper subpandurate-oblong to oblong- or ovate-lanceolate, acute to ob-

tusish, abruptly apiculate, the base broadly amplified and strongly amplexicaul, scabridulous or hirtellous, or becoming glabrate; heads 1.7–3 cm. broad; disk 0.8–1.2 cm. high, 1–2 cm. broad; rays 20–27, lemon-yellow, 8–12 mm. long, 2.5–3.2 mm. broad; achenes depressed-rhomboid, 3–4-ribbed, the convex third side with the angles and sometimes the middle longitudinally ribbed, turgid, the angles corky-thickened, the faces between the angles conspicuously rugose-wrinkled, 3–4.3 mm. long, 2.0–3.5 mm. broad, truncate at the rounded and thickened apex; awns 2 to floret, mostly dilated at apex, acute, 5–6 mm. long, equalling or slightly surpassing length of disk-floret, straight.

Distribution: bottomlands, rich low ground and thickets, and near rivers, north-central Texas near Dallas and Ft. Worth, south to vicinity of San Antonio and Industry, south-central Texas.

TEXAS: 39 miles west of San Felipe, Juli–Aug., 1844, *Lindheimer 255* (CAL, G, M TYPE, PA); expedition from western Texas to El Paso, N. Mex., May–Oct., 1849, *Wright 297* (G, NY); S. Felipe de Austin, Hooker misit, Januar, 1835, *Drummond 131* (G); 3 mi. west of San Marcos, Hays Co., June 8, 1931, *Moore & Steyermark 3000* (M); in sandy loam near Guadalupe River, Seguin, Aug. 18, 1903, *Groth 198* (F, G, NY, US); Ft. Worth, Aug. 1, 1926, *Killian 6572* (UT); rich low lands, Dallas Co., July, *Reverchon* (Curt. distr. no. 1368 b) (CAL, F, M, MU, PA); rich black soil, Bastrop Co., summer 1926, *Duval 307* (UT); tropical life zone, San Antonio, Bexar Co., June 20, 1911, *Mr. & Mrs. J. Clemens 948* (CAS, M, PO, R, US); open ground, along river, Sabinal, Uvalde Co., June 8, 1916, *E. J. Palmer 10134* (M); on prairies near Cox's Point, Calhoun Co., Aug. 12, 1920, *Drushel 4165* (M); Calvert, Aug., 1888, *Pammel* (M); Corpus Christi, Nueces Co., May 11, 1900, *Bailey 256a* (US); Corpus Christi, 1889, *Nealley 305* (US); Keller's Point, Sept. 7, 1922, *Tharp 1633* (US, UT); in a deep depression near T. & P. R. R., near Ft. Worth, Sept. 2, 1912, *Ruth 284* in part (G, M, NY, PA, US); rich low thickets, Dallas, Aug. 1882, and in Trinity Bottom, near Dallas, Aug., 1882, *Letterman* (M, NY, PA, US); Comanche Spring, New Braunfels, etc., July, 1851, *Lindheimer 919* (CAL, F, G, M, NY, PA, US, UT); Cleburne, June 19, 1930, *Whitehouse* (UT); sandy soil, Fort Bungalow, Starr Co., alt. 400 ft., April 25, 1925, *Runyon 841* (US); roadside, 5 mi. s. of San Antonio, May 16, 1920, *Schulz 532* (US).

8c. var. adenodonta f. angustior Steyermark, f. nov.¹³

Stems as tall as the variety, more glabrate in lower half, eglandular; middle and upper cauline leaves less subpandurate-

¹³ *G. microcephala* var. *adenodonta* f. *angustior* Steyermark, f. nov., foliis caulinis mediis et superioribus minus subpandurato-oblongis quam varietate, ad basem minus ampliatis, dentibus paullo latioribus et brevioribus, caulinis principalibus 4–10 cm. longis, 0.7–2 cm. latis, spathulato-oblongis vel oblongo-oblanco-latis, capitula minus conspicue subtendentibus.—Collected in rocky open ground along small streams, near Uvalde, Uvalde Co., Texas, April 28, 1928, *E. J. Palmer 33590* (Mo. Bot. Gard. Herb. no. 945114 TYPE, NY isotype).

oblong, less amplified at base, sometimes no broader or even narrower at the base than at the middle, the crenulate serrulations shallower and somewhat broader, the main cauline 4–10 cm. long, 0.7–2 cm. broad, 4–7 times longer than broad, spatulate-oblong to oblong-oblancheolate, acute to obtuse, those on floriferous branchlets subpandurate-oblong to narrowly oblong, smaller and not so conspicuous subtending the heads as in the variety.

Distribution: eastern limits of mesquite chaparral country near the Rio Grande region, in rocky open ground along stream, dry open fields adjacent to mesquite chaparral, or in dry soil of mesquite pastures, Bexar, Uvalde, Medina, Maverick, and Dimmit Counties, south-central Texas.

TEXAS: rocky soil, mesquite pasture, Bexar Co., June 10, 1919, *Schulz 106* (US); dry open field adjacent to mesquite chaparral, 3 mi. east of Hondo, Medina Co., alt. 240 m., June 8, 1931, *Moore & Steyermark 3003* (M); dry open field, ½ mi. west of Uvalde, Uvalde Co., alt. 250 m., June 8, 1931, *Moore & Steyermark 3004* (M); gumbo soil in chaparral, 10 mi. west of San Antonio Bexar Co., alt. 229 m., June 8, 1931, *Moore & Steyermark 3002* (M); Eagle Pass, April 27, 1931, *M. E. Jones 28037* (M); Carriso Spring, April 26, 1931, *M. E. Jones 28036* (CAL, M); rocky open ground along small stream, near Uvalde, Uvalde Co., April 28, 1928, *E. J. Palmer 33590* (M TYPE, NY isotype); Alpine, April 29, 1928, *E. J. Palmer 33590* (B).

8d. var. montana Steyermark, var. nov.¹⁴

Stems tall and branching as in the var. *adenodonta* but rather closely mixed glandular and villosulous; leaves mixed glandular-scabridulous or hirtellous, the middle and upper cauline serrulate with broader more deltoid coarser more acute teeth; disk about 2–2.1 cm. broad, 1.1–1.3 cm. long; awns 4.2–4.5 mm. long, acuminate to a slender apex.

Distribution: mountains, San Juan del Estado, State of Oaxaca, Mexico.

MEXICO: mountains, San Juan del Estado, State of Oaxaca, alt. 7500 ft., Aug. 13, 1894, *L. C. Smith 135* (G TYPE).

This species, with its varieties, has been identified by most authors as *G. inuloides*, and Gray considered *G. microcephala* DC., not Rothr., as only a variety of *G. inuloides*; however, as shown in a previous section under *G. inuloides*, *G. inuloides*

¹⁴ *G. microcephala* var. *montana* Steyermark, var. nov., foliis et caulibus glanduloso-villosiusculis, ceterum ut apud var. *adenodontam*.—Collected in mountains, San Juan del Estado, State of Oaxaca, Mexico, alt. 7500 ft., Aug. 13, 1894, *Rev. L. C. Smith 135* (Gray Herb. TYPE).

Willd. is a strictly Mexican species. The Texas species passing as *G. inuloides* becomes *G. microcephala* DC. and var. *adenodonta*. The more widely distributed and commoner form is the var. *adenodonta*, a variety which passes into the historical type plant, an uncommon form limited to the coastal region of south-central Texas in the vicinity of Corpus Christi and Rio Frio, and described as *G. microcephala* DC. Towards the western and southwestern limit of dispersal *G. microcephala* var. *adenodonta* is replaced by a forma *angustior* with narrower middle and upper cauline leaves, which are less amplified and amplexicaul at the base and less finely and evenly setulose-denticulate.

This species and varieties bloom earlier than any of the other species of Texas, the usual period of anthesis being from May to June.

9. *G. Palmeri* Steyermark, sp. nov.¹⁵

G. inuloides Willd. acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as to plants from Mexico, in part only (*Parry & Palmer* 371).

Herbaceous; stems corymbosely branched with several elongated erect-ascending to substrict stout monocephalous floriferous branchlets 1.5–3 dm. long, buff to light brown or suffused with reddish-purple, glabrous below, mostly sparsely villous towards the heads, 3–5 dm. or more tall; leaves gradually reduced towards heads, scarcely resinous-punctate, submembranaceous or firmly membranaceous, upper leaves regularly serrulate-denticulate or crenulate-serrulate with short broadly

¹⁵ *G. Palmeri* Steyermark, sp. nov., caulibus corymboso-ramosis, ramusculis floriferis erecto-adscendentibus vel substrictis, capitula terminalia solitaria ferentibus, infra glabris, adversum capitula plerumque parce villosis, 3–5 plus dm. altis; foliis adversum capitula non bracteiformibus et non remotis, parce resinoso-punctatis, plus minusve submembranaceis vel firme membranaceis, regulariter serrulato-denticulatis vel crenulato-serrulatis, dentibus brevibus sed salientibus, late oblongis, 1.5–6 cm. longis, 0.8–1.5 cm. latis, ovato-oblongis vel ovatis vel late oblongis, obtusis vel acutis, glabratis vel parce puberulis; bracteis involucri glabris; achaeniis 2.5–3 mm. longis, 1.3–1.7 mm. latis, laevibus vel paullum rugulosis vel minute verruculosus; aristis 3.5–5.5 mm. longis.—Collected at Alvarez, State of San Luis Potosi, Mexico, Sept. 28–Oct. 3, 1902, *Ed. Palmer* 163 (U. S. Nat. Herb. no. 397709 TYPE, G, M, NY, isotypes).

oblong to deltoid, obtuse to acute serrulations, 1.5–6 cm. long, 0.8–1.5 cm. broad, oblanceolate-spatulate to (the upper) ovate or broadly oblong, obtuse to acute, amplexicaul to (the upper) subcordate, glabrate to sparsely puberulent; heads radiate, 3–4 cm. broad; disk depressed-hemispherical, 0.8–1 cm. high, 1.6–2.2 cm. broad; involucral bracts mostly not resinous, 4–5-seriate, 4–9 mm. long, linear-lanceolate to lanceolate with gradually acuminate or subulate tips, glabrous, the outer and middle bracts elongated, subequal, the upper $\frac{1}{2}$ – $\frac{1}{3}$ free and spreading, flattened, firmly membranaceous; receptacle moderately foveolate; rays 25–35, lamina 10–13 mm. long, 2.5–3 mm. broad; achenes oblong, 2.5–3 mm. long, 1.3–1.7 mm. broad, dark brown, smooth to slightly wrinkled or finely verruculose, horizontally truncate at apex; awns 2–4, 5 on some ray-florets, nearly capillary, entire, acute, 3.5–5.5 mm. long, equalling length of disk-floret.

Distribution: States of San Luis Potosi and Queretaro, central Mexico.

MEXICO: SAN LUIS POTOSI—in the region of San Luis Potosi, 22° N. Lat., alt. 6000–8000 ft., 1878, *Parry & Palmer 371* (G, M, PA, US); Alvarez, Sept. 28–Oct. 3, 1902, *Ed. Palmer 163* (G, M, NY, US TYPE).

10. *G. subdecurrens* DC. Prodr. **5**: 315. 1836; Steud. Nom. Bot. ed. 2. **1**: 708. 1840; Hemsl. Biol. Cent.-Am. Bot. **2**: 113. 1881; Gray in Proc. Am. Acad. **17**: 208. 1882; Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, as synonym.

G. squarrosa (Pursh) Dunal var. *hirtella* Rob. & Greenm. in Am. Jour. Sci. **50**: 153. 1895.

Herbaceous; stems mostly several, corymbosely branched near or below the middle with slender divaricate branchlets bearing several to many heads, light brown to suffused with purplish or reddish purple, glabrate, puberulent, or mixed glandular-puberulent, 2–6 dm. tall; leaves gradually reduced towards heads, slightly or moderately resinous-punctate, subcoriaceous and firm, closely obtusely serrulate to crenulate-serrulate, the small teeth mostly resinous-tipped, 1–6 cm. long, 0.4–1.7 cm. broad, 2–4 times longer than broad, narrowly oblong to (the upper) ovate-oblong, obtuse, subamplexicaul to (the upper) subcordate, those near heads lanceolate-deltoid to

deltoid-ovate with abruptly subulate or caudate tips, glabrous, glandular, or mixed glandular-puberulent; heads radiate, 1.7–3 cm. broad; disk depressed-hemispherical, the sides rather distending downwards in fruit, 0.8–1 cm. high, 1.3–2.5 cm. broad; involucre bracts moderately and rather conspicuously resinous, 4–6-seriate, 2.5–8 mm. long, mostly green throughout, glabrous, glandular or puberulent, upper $\frac{1}{5}$ – $\frac{2}{3}$ free and loosely reflexed to somewhat recurved, subterete, thickened, subcoriaceous, with short tips 1–4 mm. long, the outer linear- to oblong-lanceolate with subulate or acuminate tips, the outermost reflexed at base of involucre; receptacle conspicuously foveolate; rays 20–30, dull orange-yellow, lamina 5–11 mm. long; achenes broadly oblong and subtergic, compressed-subquadrangular, 2.8–4 mm. long, 1.5–2.1 mm. broad, light to dark brown, irregularly shallowly wrinkled when mature, horizontally truncate at apex; awns 2–3 to the floret, capillary-linear, entire to remotely marked in upper half with few short teeth, mostly attenuate to slender-acuminate apex, 3–5 mm. long, equalling length of floret, straight.

Distribution: hills and slopes between 5000 and 7500 ft. alt., Villalpando, State of Guanajuato, south-central Mexico and south in western Oaxaca, southern Mexico.

MEXICO: SAN LUIS POTOSI—ex convalli San Luis Potosi, in umbrosis prope Penosio, Aug., 1876 and 1877, *Schaffner 309* (G, NY); GUANAJUATO—"Villalpando au de Guanajuato," 1829, *Mendez* (G isotype, CAL fragment of TYPE, CAL, G, US photograph of TYPE); OAXACA—La Carbonera, alt. 1600 m., Aug., 1897, *Conzatti & Gonzalez 388* (G); La Carbonera, Distrito de Etla, alt. 2200 m., June 28, 1920, *Conzatti 4014* (US); La Carbonera, alt. 7000 ft., Sept. 20, 1895, *L. C. Smith 803* (G); hills, Las Sedas, alt. 6000 ft., Aug. 16, 1894, *Pringle 4805* (CAL, G, M, MA, MU, NY, PA, US); Las Sedas, Distrito de Etla, Oct. 10, 1933, *Conzatti 4999* (M).

From *G. inuloides* Willd., with which it has sometimes been confused, *G. subdecurrens* DC. may be distinguished by the conspicuous balsamic-resinous heads, and by the more resinous-punctate, firmer and more subcoriaceous leaves with regularly and obtusely crenulate-serrulate margins. Further, the mature achenes in *G. subdecurrens* are shallowly wrinkled on the faces, whereas in *G. inuloides* the surface is smooth or, at most, slightly striate.

Grindelia squarrosa var. *hirtella* Rob. & Greenm. has been

found to be synonymous with *G. subdecurrens*, and although Robinson and Greenman treated their plant as only an hirtellous variety of *G. squarrosa*, specific differences between the two are quite manifest. From *G. squarrosa*, *G. subdecurrens* (*G. squarrosa* var. *hirtella*) is at once distinguished by its more nearly capillary subentire pappus awns, shallowly wrinkled achenial surfaces, puberulent or villosulous stems (at least above), and by the leaves, which are much more reduced towards the heads and more attenuate-caudate at the apex. Other points of difference are that *G. subdecurrens* has shorter stems than *G. squarrosa*, and its leaves have a decidedly dark forest-green caste, whereas those of *G. squarrosa* are duller or more bluish- or grayish-green.

11. *G. Havardii* Steyermark, sp. nov.¹⁶

G. squarrosa var. *grandiflora* (Hook.) Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to plant of *Wright* only, not plants of *Berlandier*, *Lindheimer*, and *Reverchon*.

G. squarrosa (Pursh) Dunal acc. to Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 655. 1915, as to plant from west of Roswell, N. Mex.

Apparently biennial; stems stoutish, one to several from a subherbaceous base, corymbosely branched above with divaricate to spreading-ascending elongated floriferous branchlets bearing several to many heads, ochraceous-buff, light pinkish-cinnamon to stramineous, glabrous to minutely glandular-puberulent, 3–9 dm. tall; leaves gradually reduced on flowering

¹⁶ *G. Havardii* Steyermark, sp. nov., caulibus glabris vel minute et moderatim glanduloso-puberulis, 3–9 dm. altis; foliis firme subcoriaceis, caulinis principalibus serratis vel dentatis cum dentibus brevibus vel salientibus, obtusis vel salienter acutis, illis in ramusculis floriferis plerumque contiguae et regulariter crenato-dentatis vel crenato-serratis cum dentibus resiniferis obtusis, 0.7–5.5 cm. longis, 0.4–2.2 cm. latis, 2–3 plo longioribus quam latis, caulinis inferioribus et mediis oblongis vel deltoideo-ovatis, amplexicaulibus vel subamplexicaulibus, glabris vel minute scabridiusculis; involucrio abundanter resinoso, 5–6-seriato, bracteis exterioribus et mediis cum parte superiore $\frac{1}{2}$ – $\frac{2}{3}$ libera, patentibus vel squarrosis; aristis integris vel remote serrulatis, 4–7 mm. longis, disci flores aequantibus.—Collected on dry gravelly wash near mouth of McKittrick Canyon, Guadalupe Mountains, Culberson Co., Texas, alt. 2000 ft., July 23, 1931, *Moore & Steyermark 3607* (Mo. Bot. Gard. Herb. no. 1031229 TYPE).

branchlets, moderately resinous-punctate, firmly subcoriaceous, dark green, the main cauline serrate or dentate with shallow or salient, obtuse to sharply acute teeth, those on floriferous branchlets mostly closely crenate-dentate with conspicuous obtuse resinous-tipped teeth, sometimes sharply serrate with sharply acute teeth, 0.7–5.5 cm. long, 0.4–2.2 cm. broad, oblong to (the upper) ovate, acute to acuminate, subamplexicaul to amplexicaul, glabrous to rather closely scabridulous; heads radiate, 2.5–3 cm. broad; disk depressed-hemispherical, 0.8–1.3 cm. high, 1.2–2.2 cm. broad; involueral bracts abundantly resinous, 5–6-seriate, 4–10 mm. long, linear to lanceolate with gradually acuminate to subulate subcoriaceous tips, glabrous, the upper $\frac{1}{2}$ – $\frac{2}{3}$ free and spreading or squarrose, the outermost at base of involucre sometimes crowded and reflexed or descending; rays 18–25, dull yellow or lemon-yellow, rather narrowly oblong, obtuse, the lamina 9–11 mm. long, 2.5–3 mm. broad; achenes narrowly oblong, stramineous to light brown, 3–3.5 mm. long, 1–1.5 mm. broad, smooth, shining, compressed, horizontally truncate at apex; awns 2 to the floret, entire or remotely serrulate, 4–7 mm. long, slender, slightly dilated to an acute apex, equalling length of disk-floret, straight.

Distribution: along dry gravelly washes, dry stream beds, rocky stream courses, and occasionally in fields near streams, southeastern New Mexico in vicinity of Roswell, Chaves Co., south along the eastern edge of Rocky Mountain escarpment in the Guadalupe and Chisos Mountains of western Texas, east to Devil's River, Valverde Co., and Big Spring, Howard Co., western Texas.

TEXAS: "western Texas to El Paso, N. Mex.," May–Oct., 1849, *Wright 296* (G, US); Rio Bravo del N., Rio San Pedro, *Schott* (NY); dry gravelly wash near mouth of McKittrick Canyon, Guadalupe Mts., Culberson Co., alt. 2000 m., July 23, 1931, *Moore & Steyermark 3607* (M TYPE); open valley, Nail Place, Chisos Mts., Aug., 1916, *Young* (UT); Secor River, Sept., 1881, *Havard 63* (NY, US).

NEW MEXICO: dry field, Black River, Eddy Co., Aug. 12–20, 1924, *Standley 40439* (US); 20 mi. west of Roswell, July 28, 1905, *Wootton* (NY, US); 35 mi. west of Roswell, Chaves Co., alt. about 3800 ft., Aug., 1900, *F. S. & E. S. Earle 509* (M, NY); 35 mi. west of Roswell, Aug. 29, 1900, *F. S. & E. S. Earle 571* (M, MU, NY, US).

This species may be considered intermediate between *G. subdecurrens* and *G. squarrosa*. It has been derived from the more ancient Mexican *G. subdecurrens* stock, on the one hand,

and has given rise, on the other, to the *G. squarrosa* group. *Grindelia Havardii*, with a trace of minute puberulence or glandularity of the stems and leaves, loosely spreading involucral bracts, mostly ovate to deltoid-ovate uppermost

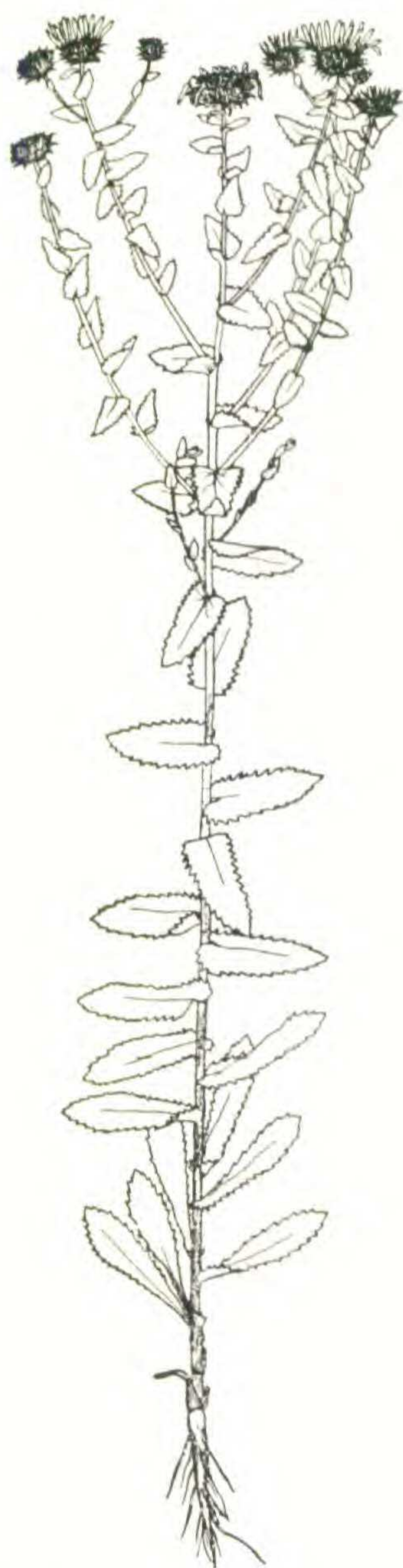


Fig. 11. *G. Havardii*. $\times \frac{1}{5}$.

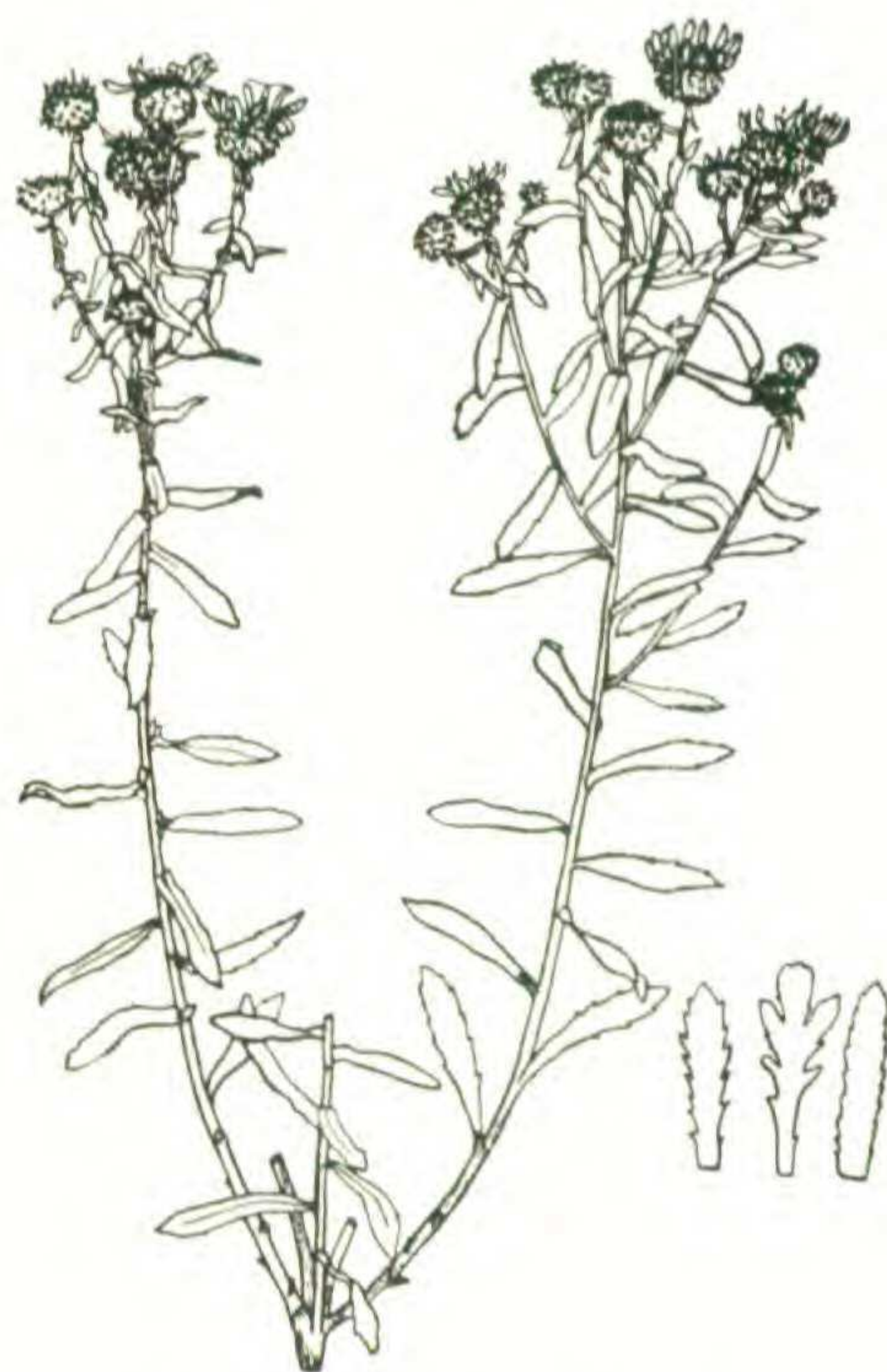


Fig. 12. *G. perennis*. $\times \frac{1}{5}$.

leaves, and the usually subentire pappus awns, recalls some characteristics of *G. subdecurrens*, while its taller stems, large heads, paleaceous pappus awns, and smooth achenes are characters found in *G. squarrosa*.

12. *G. squarrosa* (Pursh) Dunal in Mem. Mus. Par. **5**: 50. 1819; DC. Prodr. **5**: 315. 1836; Torr. & Gray, Fl. N. Am. **2**: 247. 1842, as to name mostly and synonymy in part, excluding most of range given; Wats. Bot. U. S. Geol. Expl. 40th Par. [Bot. King's Exp.] **5**: 163. 1871, as to name only; Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, in part only; Britt. & Brown, Ill. Fl. N. States **3**: 321. 1898, and ed. 2. **3**: 371. 1913; Small, Fl. Southeast. U. S. 1180. 1903, and ed. 2. 1180. 1913, mostly as to name, excluding description as to "leaf-blades . . . spinose-serrate"; Rob. & Fern. in Gray's New Man. Bot. ed. 7. 786. 1908; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909, in small part, and excluding plants from Mexico; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915, as to name only; Rydb. Fl. Rocky Mts. 848. 1917, excluding plants from Saskatchewan and Arizona; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 535. 1925, mostly as to name only, and excluding *G. serrulata*; Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. *fig. 547*. 1932, excluding plants from Arizona and N. Dakota.

Donia squarrosa Pursh, Fl. Am. Sept. **2**: 559. 1814; Sims, Bot. Mag. **41**: *pl. 1706*. 1815; Nutt. Gen. N. Am. Pl. **2**: 163. 1818; Eaton, Man. Bot. N. Am. ed. 6. 127. 1833, and ed. 7. 281. 1836; Hook. Fl. Bor. Am. **2**: 25. [1834] 1840, as to name only, excluding plants of *Richardson*, *Drummond*, and *Douglas*; Eaton & Wright, N. Am. Bot. ed. 8. 227. 1840.

Aurelia amplexicaulis Cass. Dict. Sci. Nat. **37**: 468. 1825.

G. squarrosa var. *grandiflora* (Hook.) Gray acc. to Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, as to description in part as to "upper leaves . . . with . . . obtuse teeth."

G. nana Nutt. acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 556. 1906, as to plants of *Horner 566* and *Hardwick* only.

Biennial, or sometimes perennial in cultivation; stems often solitary from an herbaceous base, stout, corymbosely branched usually above the middle with strongly divergent many-flowered branchlets, usually white to stramineous or occasionally

suffused with rose-purple, glabrous, mostly 0.4–1 m. tall, uniformly leafy throughout; leaves typically thick and subcoriaceous, dark, drab- or bluish-green, conspicuously and abundantly punctate, especially the middle and upper cauline and those on floriferous branchlets closely and evenly saliently crenulate-serrate, with obtuse resiniferous teeth projecting obliquely outwards, the main middle and upper cauline 3–7 cm. long, typically 1.0–2 cm. (sometimes 0.7–1 cm.) broad, mostly 2–4 times longer than broad, ovate- to pandurately or broadly oblong to (the lower) obovate- or spatulate-oblong, mostly obtuse or acutish, somewhat apiculate, strongly amplexicaul, glabrous; heads radiate, numerous, mostly 2.2–3.2 cm. broad; disk depressed, quadrate-hemispherical, the receptacle conspicuously distending downward and outward in fruit, becoming then horizontally subreniform, mostly 0.6–1.1 cm. high, 1.2–2 cm. broad; involucral bracts conspicuously and abundantly resinous, 5–6-seriate, the upper $\frac{1}{2}$ to $\frac{2}{3}$ free and loosely squarrose to moderately or even strongly reflexed, the outer loose mostly throughout the length, crowded and strongly descending or downwardly deflexed, usually 4–9 mm. long, linear, lanceolate-linear, to (the inner) lanceolate-subulate, with mostly subterete subcoriaceous tips; receptacle conspicuously foveolate; rays typically 24–36, narrowly oblong-elliptic or oblanceolate, acutish, lemon-yellow to bright yellow, lamina 8–10 mm. long, 1.5–2.5 mm. broad; achenes quadrate-oblong, 2.3–3 mm. long, mostly 1–1.5 mm. broad, light brown to stramineous, striated about the angles, horizontally truncate at apex; awns frequently 2–3, or as many as 6, slender, acutish, subentire to moderately serrulate or setulose-serrulate, 3–5 mm. long, about $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: indigenous to the central prairie and plains region from southern Minnesota and South Dakota south into southeastern Wyoming, Iowa, Nebraska, Kansas, and Texas, where it may also occur as a weed in pastures, fields, or along roadsides; also introduced elsewhere eastward and westward.

UNITED STATES:

MAINE: Portland, July 19, 1910, *Stubbs* (G).

VERMONT: open field, Brandon, Sept. 8, 1920, *Dutton* (CAR).

MASSACHUSETTS: Sherborn, Aug. 2, 1910, *Loomis* (G); Worcester, Sept. 10, 1913, *Horr* (G); Chatham, Aug., 1919, *Lawton* (G).

RHODE ISLAND: waste, Providence, Aug. 27, 1892, *Collins* (G).

NEW YORK: Millburn, Long Island, Aug. 2, 1896, *John* (PA); Patterson, Sept., 1911, *Pendleton* (NY).

NEW JERSEY: near Swedesboro, July, 1895, *Lippincott* (NY, PA).

PENNSYLVANIA: Chestnut Hill, Lancaster Co., Aug., 1917, *Urban* (NY); sea-shore, at North East, Erie Co., Aug. 22, 1908, *Patterson* (CAR).

DELAWARE: sandy field, near Milton, Aug. 17, 1899, *Commons* (G, PA).

MARYLAND: field east of Pres. Silvester's House, College Park, July 29, 1903, *Norton* (M).

DISTRICT OF COLUMBIA: mouth of Hunting Creek, July 30, 1916, *Layton* (US).

VIRGINIA: New Alexandria, Fairfax Co., Aug. 13, 1910, *Pennell 2581* (PA); roadside, Alexandria, Alexandria Co., July 31, 1904, *Dowell 3050* (M).

OHIO: in newly seeded alfalfa field, Jersey, July 29, 1909, *Condit* (CAL).

MICHIGAN: roadside, Grande Traverse Co., Aug. 24, 1919, *McAtee 3081* (US); Zoo Park, Oakland Co., Aug. 9, 1916, *Chandler* (US).

INDIANA: frequent as a weed in a very sandy fallow field about $\frac{3}{4}$ mi. south-east of Ontario, Lagrange Co., July 12, 1922, *Deam 36846* (D, G, NY, PA, US).

WISCONSIN: Dresser Junction, Polk Co., Aug. 15, 1900, *Baker* (G, PO); C. M. & St. P. R. R. track, on bay near junction, Madison, June 24, and Aug. 13, 1889, *Trelease* (M).

ILLINOIS: roadside, Evanston, Aug. 16, 1911, *Sherff* (G, M, US); sandy banks of Mississippi, opposite St. Louis, Aug., 1842, *Engelmann* (M).

MINNESOTA: Ada, Sept. 3, 1920, *Hanson* (PO); sandy prairies, Brainerd, Aug., 1891, *Sandberg* (MU); dry prairies, near Minneapolis, Aug., 1894, *Anderson* (MU).

IOWA: Ames, Aug., 1904, *Pammel 38* (G, M, NY, US); dry ground, Lee Co., Aug. 24, 1892, *Bush* (M); Council Bluffs, Sept. 10, 1909, *Somes 3277* (US); Moscow, Aug. 26, 1909, *Somes 3712* (US).

MISSOURI: pastures, dry slopes south of Hannibal, Marion Co., Oct. 9 and 12, 1916, *Davis 5780* (CAL, M, R, UT); introduced, Kansas City, Aug. 29, 1906, *Bush 4093* (G, M, NY, US); near Pacific, 1899, *Letterman* (M, US); sandy banks of Mississippi, St. Louis, Aug., 1842, *Engelmann* (G); Carroll Co., Sept. 18, 1890, *Bush* (MO).

ARKANSAS: sandy banks of Arkansas River, 20 miles above Little Rock, Aug., 1835, *Engelmann* (M); Little Rock, June, 1835, *Leyden* (M).

SOUTH DAKOTA: prairies in the camp near the old Maha village, Aug. 17, 1804, *Lewis & Clark* (PA TYPE); Brookings, Sept., 1893, *Thorner* (M).

NEBRASKA: Long Island, Omaha, Aug. 20, 1898, *Williamson* (PA); Crete, Sept., 1885, *Seigerist* (MU); waste places, Otoe Co., Aug. 15, 1898, *Fitzpatrick* (G); Callaway, Sept. 7, 1902, *Bates 2592* (G); Red Cloud, Aug. 5, 1907, *Bates* (MU); Imperial, Aug. 8, 1912, *Pool & Folsom* (UW).

KANSAS: Lawrence, Aug., 1884, *Oyster 3537* (F, M, NY); prairie, Riley Co., Sept. 25, 1895, *Norton 218* (G, M, NY, R, US); prairies, Topeka, Sept. 16, 1890, *Smyth 324* (NY, US); Tribune, Greeley Co., Aug. 13, 1892, and Aug. 26, 1898, *Reed* (CAL, N).

TEXAS: rocky bluffs, Archer and Baylor Co., Sept., 1879, *Reverchon 30* (G, NY); rich land, Archer Co., Sept., 1879, *Reverchon 471* (M); sandy plains, Graham, Oct. 29, 1902, *Reverchon* (M).

WYOMING: western foothills, Newcastle, July 9, 1927, *Hayward 2013* (R); Fort Laramie, Aug. 18, *Hayden* (M); Fort Laramie, Sept. 19, 1859, *H. Engelmann* (M); Laramie, Sept. 6, 1898, *A. Nelson 5281* (G, M, N, NY, R, US).

COLORADO: Denver, Sept., 1888, *Eccles* (NY); 1 mi. w. of Firstview, Cheyenne Co., alt. 1375 m., Aug. 31, 1931, *Moore & Steyermark* 3786 (M).

IDAHO: shores of Lake Pend d'Oreille, alt. 650 m., Oct. 1, 1895, *Leiberg* 1658 (CAL, F, G, M, NY, PO, US).

UTAH: Salt Lake City, Salt Lake Co., Oct. 12, 1907, *Garrett* 2200 (GA); dry roadside, Provo Bench, Utah Co., alt. 5000 ft., Aug. 30, 1932, *Larsen* 6099 (BY).

NEVADA: as a weed in waste places, Eureka, Aug. 25, 1931, *J. T. Howell* 7969 (CAS).

WASHINGTON: along roadside, 6 miles west of Wenatchee, Kittitas Co., alt. 365 m., Aug. 13, 1931, *Moore & Steyermark* 3693 (M); Pullman, Aug. 18, 1895, *Hardwick* (G).

OREGON: low white land, Benton Co., Aug., 1897, *Craig* (B).

CANADA: ONTARIO—dry soil, Pelham Road, St. Catherines, Aug. 14, 1898, *Carroll* (CAN).

12a. f. *depressa* Steyermark, f. nov.¹⁷

Plants low and dwarfed; stems mostly several and subcaespitose, 1–2.5 dm. tall.

Distribution: xerophytic regions in the sand hills of central Nebraska, Thomas Co., and alkaline flats around Salt Lake City, Utah.

NEBRASKA: on Middle Loup River, near Thedford, Thomas Co., Sept. 12, 1893, *Rydberg* 1760 (G, NY, US).

UTAH: 16 mi. east of Salt Lake City, Salt Lake Co., alt. 1600 m., Aug. 23, 1931, *Moore & Steyermark* 3766 (M); alkali flat, 5 mi. west of Salt Lake City, alt. 1300 m., Aug. 23, 1931, *Moore & Steyermark* 3768 (M TYPE).

12b. var. *nuda* (Wood) Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, excluding plants from New Mexico and Colorado; Britt. & Brown, Ill. Fl. N. States 3: 321. 1898, and ed. 2. 3: 371. 1913, as synonym; Rob. & Fern. in Gray's New Man. Bot. ed. 7. 786. 1908; Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. 1932, as synonym.

G. nuda Wood in Coulter's Bot. Gaz. 3: 50. 1878; Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as synonym; Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. 1932.

G. squarrosa var. *grandiflora* (Pursh) Dunal acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to plant of *Berlandier* 541 (1921).

Stems 1.5–6 dm. tall; leaves closely and rather evenly cre-

¹⁷ *G. squarrosa* f. *depressa* Steyermark, f. nov., planta pusilla et humilis; caulibus paucibus vel multis, subcaespitosis, 1–2.5 dm. altis.—Collected in alkali flat, 5 miles west of Salt Lake City, Salt Lake Co., Utah, alt. 1300 m., Aug. 23, 1931, *Moore & Steyermark* 3768 (Mo. Bot. Gard. Herb. no. 1027218 TYPE).

nate, the main upper and middle cauline 1.5–4.5 cm. long, 0.8–1.7 cm. broad, $1\frac{1}{2}$ –3 times longer than broad, oval to (the lower) ovate- or broadly oblong, obtuse, subamplexicaul, glabrous; heads discoid; disk broadly hemispherical, 0.8–1.5 cm. high, 1.3–2.3 cm. broad; involucral bracts loosely squarrose.

Distribution: dry open clayey or loamy ground on plains and prairies and exsiccated lake bottoms, or introduced along roadsides and railroads, from southwestern Kansas south to south-central Texas at the southern limit of the Edwards Plateau and west to the northern Texas-New Mexico boundary line; also casually introduced along railroads in west- and east-central Missouri and New Jersey.

NEW JERSEY: Swedesboro, July 30, 1895, *Lippincott* (PB).

MISSOURI: railroad tracks near Allenton, 1879, *Letterman* (M); common, Courtney, Oct. 21, 1891, and 1894, *Bush* 390 (G, M, NY).

KANSAS: vicinity of Liberal, Sept. 22, 1912, *Rose & Fitch* 17129 (NY, US); local, prairies, Emporia, Sept., 1890, *Bodin* (MU); Clark Co., Sept. 17, 1898, *White* (NY).

OKLAHOMA: Indian Territory, *Wilcox* (NY TYPE); grassy roadside, Shattuck, Ellis Co., Oct. 11, 1913, *Stevens* 2916 (G, M, MU, NY, US); sandy loam near Willow, Greer Co., Aug. 8, 1927, *Stratton* 332 (M); Willard, Aug. 18, 1933, *Coffman* (MO); dry open ground, granite areas, Wichita National Forest, Comanche Co., *E. J. Palmer* 41965 (M).

TEXAS: Erath Co., July 28, 1921, *Gough* (PO); 5 mi. northwest of Bluffdale, Oct. 14, 1891, *Ward* (US); Comancheris orientales du Texas, Nov. et Dec., 1828, *Berlandier* 541 (1921) (G, NY); Bosque Co., Sept. 15, 1929, *Whitehouse* (UT); Amarillo, July 27, 1926, *Tharp* 4579 (UT); roadside near Canyon City, Randall Co., Aug. 14, 1900, *Eggert* (M); dry open ground, Brownwood, Brown Co., Oct. 23, 1916, *E. J. Palmer* 11111 (M); Spring Creek, south of Tankersley, Tom Green Co., Sept. 13, 1932, *Cory* 4861 (CO); Ranch Experiment Station, Edwards Co., Oct. 6, 1932, *Cory* 5014 (CO).

COLORADO: Pueblo, 1882, *Woodward* (G, [Woodward herb.]).

NEW MEXICO: clay soil, Nara Visa, Sept. 20, 1910, *Fisher* (MU, US).

12c. var. nuda f. angustior Steyermark, f. nov.¹⁸

Main cauline leaves 2.5–5.5 cm. long, 0.3–0.9 cm. broad, mostly 4–10 times longer than broad, chiefly linear- or narrowly oblong and acutish, rather closely and evenly crenate or crenate-serrate.

Distribution: northwestern Texas, and introduced in western Missouri.

MISSOURI: Jackson Co., July 15, 1892, *Bush* (M).

¹⁸ *G. squarrosa* var. *nuda* f. *angustior* Steyermark, f. nov., foliis caulinis principalibus 2.5–5.5 cm. longis, 0.3–0.9 cm. latis, plerumque 4–7 plo longioribus quam latis, plerumque lineari-oblongis et acutiusculis, plus minusve contiguae et regulariter crenatis vel crenato-serratis.—Collected in roadside marsh 16 mi. east of Sockney on Quitaque road, Floyd Co., Texas, Aug. 23, 1921, *Ferris & Duncan* 3391 (Mo. Bot. Gard. Herb. no. 902235 TYPE, CAS, NY, isotypes).

TEXAS: staked plains, May 26-30, 1899, *Bray 448* (US); on rocky hills and by roadside, Hockley Co., Sept. 3, 1927, *Harris 110* (US); Lubbock, May 3, 1925, *Wooton* (US); roadside marsh, 16 mi. east of Sockney on Quitaque Road, Floyd Co., Aug. 23, 1921, *Ferris & Duncan 3391* (M TYPE, CAS, NY, isotypes); prairie, Amarillo, Aug. 7, 1903, *Reverchon* (M); stony hills, Bexar Co., Sept. 8, 1900, *Eggert* (M); 3 mi. north of Hale Center, staked plains, *without collector* (UT); lake bed, Nunn Ranch, Reagan Co., Sept. 19, 1932, *Cory 4928* (CO).

12d. var. *serrulata* (Rydberg) Steyermark in Ann. Mo. Bot. Gard. **21**: 227. 1934.

G. serrulata Rydb. in Bull. Torr. Bot. Club **31**: 646. 1904; in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915; Rydb. Fl. Rocky Mts. 848. 1917; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 535. 1925, as synonym; Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. 1932.

G. squarrosa (Pursh) Dunal acc. to Richardson, Bot. App. Franklin Narr. 749. 1823; acc. to Torr. & Gray, Fl. N. Am. **2**: 247. 1842, in major part; acc. to Wats. Bot. U. S. Geol. Expl. 40th Par. [Bot. King's Exp.] **5**: 163. 1871; acc. to Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, in large part; acc. to Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909, in part; acc. to Rydb. Fl. Rocky Mts. 848. 1917, in part; acc. to Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 535. 1925.

Herbaceous biennial; stems one to usually several, slender, more loosely corymbosely branched, frequently suffused with rose-purple to stramineous, mostly smaller than the species, 1.5-6 dm. tall; leaves (especially the middle and upper) mostly closely crenulate-serrulate with short and obtuse teeth to remotely serrulate, the main middle and upper cauline 3-6.5 cm. long, typically 0.5-1.3 cm. (rarely up to 1.7 cm.) broad, narrowly linear-oblong or oblong to oblanceolate; disk 0.6-1.0 cm. high, 0.8-1.5 cm. (rarely up to 2.0 cm.) broad; involucral bracts revolute to moderately reflexed or squarrose; rays more elongated, mostly brighter or more golden yellow than in species, the lamina usually 10-14 mm. (occasionally 8-10 mm.) long, 2-2.5 mm. broad, spatulate-oblong to oblanceolate.

Distribution: waste ground, along roadsides, low ground along streams and dry open places in Colorado, northern and central Utah, northeastern Arizona, north-

western New Mexico, and southeastern Wyoming where seemingly native; apparently introduced casually elsewhere eastward and westward in Washington, California, Nevada, Idaho, South Dakota, Nebraska, Missouri, Minnesota, Pennsylvania, Illinois, Michigan, Connecticut, Canada, etc.

UNITED STATES:

CONNECTICUT: waste ground, Nangatuck, July 19, 1908, *Blewitt* (G [Woodward herb.]).

NEW YORK: gravelly pasture slope, east of Plant Breeding Gardens, College Farm, Ithaca, Aug. 11, 1915, *Dean & Eames 5096* (G).

PENNSYLVANIA: Erie Co., *Guttenberg* (CAR).

MICHIGAN: on dry grounds, Oxford, Sept. 24, 1924, *Farwell 7195* (G).

INDIANA: near Hudson Lake, La Porte Co., Aug. 13, 1914, *Nieuwland* (D); very sandy fallow field in sec. 20, about 2½ mi. west of Flint, Steuben Co., Aug. 29, 1932, *Deam 52901* (D).

ILLINOIS: roadsides, Golconda, Aug. 20, 1902, *Gleason* (G).

MINNESOTA: in dry or moist soil, Brainerd, Aug. 8, 1903, *Mell & Knopf* (M); prairies, Rock Co., *Leiberg* (MU); river flat on U. of Minn. campus, Nov. 2, 1931, *Moyle* (MU); St. Vincent, Kittson Co., Aug., 1900, *Ballard 2554* (MU).

MISSOURI: introduced, Medill, Aug. 24, 1920, *Bush 9174* (M); Jeffrey pasture, north of stone wall, 600 High St., Columbia, Aug. 5, 1933, *Jeffrey 100* (MO); Agriculture Experiment Field, Columbia, June 28, 1928, *Rickett* (MO).

NORTH DAKOTA: moist hillsides, Faith, Aug. 8, 1912, *Moyer 193* (MU); black alluvial loam, in the vicinity of Fargo, alt. 905 ft., Aug. 20, 1901, *Waldron & Manns* (G, R, US).

SOUTH DAKOTA: Aberdeen, Aug., 1895, and Aug., 1896, *Griffiths* (F, MU); waste places, Deadwood, Aug. 5, 1913, *Rydberg 171* (F, G, M, MU, NY, R, US); prairie, Forestburg, Sanborn Co., July 15, 1918, *Visher 4411* (M).

NEBRASKA: Scott's Bluff Co., Aug. 22, and Sept., 1901, *Baker* (M); Carter Cañon, Scott's Bluff Co., July 25, 1891, *Rydberg* (NY).

MONTANA: Seven Mile Creek, 10 mi. below Glendive, Aug. 13, 1883, *Ward* (US).

WYOMING: open clay slopes near Hillsdale, Aug. 28, 1926, *Heller 14315* (M); Black Hills, on upper Cole Creek, Aug. 1, 1856, *H. Engelmann* (M).

COLORADO: common on dry plains, Denver, Sept. 1, 1910, *Eastwood 75* (M); prairie, Denver, alt. 5300 ft., Sept. 5, 1917, *Clokey 2950* (F, NY, R, US); dry soil, Buena Vista, alt. 8500 ft., Aug. 21, 1919, *Clokey 3316* (CAS, F, G, M, NY, PO, R, US, UT); Fort Collins, July 7, 1884, *Sheldon 3537* (CAL); 12 mi. west of Salida, Chaffee Co., alt. 2300 m., Aug. 30, 1931, *Moore & Steyermark 3781* (M); Fort Collins, alt. 5000 ft., Sept. 2, 1897, *Crandall* (MA, R); Fort Collins, alt. 5000 ft., Aug. 10, 1891, *Cowen* (NY TYPE of *G. serrulata*).

NEW MEXICO: along river, vicinity of Cedar Hill, San Juan Co., alt. about 1900 m., Aug. 17, 1911, *Standley 8044* (US).

ARIZONA: in sandy places, Tuba, alt. 3000 ft., July 6, 1927, *Cottam 2590* (BY).

IDAHO: Lake Coeur d'Alene, Aug. 3-4, 1926, *Epling & Houck 10032* (M).

UTAH: Wasatch Mts., alt. 6000 ft., Aug., 1869, *Watson 582* (G, NY, US); Garfield Beach on the Great Salt Lake, July 15, 1905, *Rydberg & Carlton 6916* (NY); Salt Lake City, July 23, 1879, *M. E. Jones 1062* (F, NY, PO, US).

NEVADA: Reno, July 29, 1897, *Hillman* (PO); Reno, Washoe Co., alt. 4500 ft., Aug. 10, 1912, *Heller 10639* (CAL, G, M, NY, PA, US).

WASHINGTON: small dense patches in the bottom lands near Lake Chelan, Chelan, Okanogan Co., July, 1897, *Elmer* 498 (M, MU, NY, PO, US).

CALIFORNIA: Antelope Valley, Los Angeles Co., Aug. 18, 1906, *Eastwood* (CAS); Rock Creek, desert slopes of the San Gabriel Mts., Los Angeles Co., alt. 3800 ft., July 2-4, 1908, *Abrams & McGregor* 626 (NY, US).

CANADA: ONTARIO—Fort Williams, along C. P. R. R., Aug. 7, 1912, *Williamson* 2163 (PA); MANITOBA—Winnipeg, July 19, 1887, *Fowler* (M, MA).

Grindelia squarrosa has, like *G. inuloides*, been a catch-all for several distinct entities, and for a species with a relatively large distribution and which is of economic importance as a weed it has surely not received its share of critical taxonomic attention. The historical *Lewis & Clark* specimen, which is the type of the species, must be considered as typical of *G. squarrosa*. This has leaves averaging 2-4 times longer than broad, and the middle and upper cauline leaves are ovate to broadly oblong.

In passing westward and southwestward into Colorado, Utah, and northwestern New Mexico, *G. squarrosa* is replaced by the var. *serrulata*, in which the leaves still retain the regularly crenulate-serrulate margins characteristic of the species, but have become narrower and more elongated (narrowly linear-oblong to oblanceolate). Sometimes the line of demarcation between the species and var. *serrulata* is not well defined, but is distinct in those plants found in the characteristic portions of their ranges, *G. squarrosa* being mostly found in the more eastern portion and var. *serrulata* in the more western portion.

Grindelia squarrosa var. *nuda* occupies a more southern portion of the range, being found principally in southern Kansas, Oklahoma, and western and north-central Texas. This variety and its forma *angustior* are common in Texas, whereas typical *G. squarrosa* reaches its southern limit in northern Texas.

Numerous collections taken at or near the margins of range overlap between *G. squarrosa* and var. *serrulata* are intermediate and probably represent hybrids or are of hybrid origin. Among such collections may be mentioned that of *Goodding* 533, *Burglehaus* from Brainerd, Minnesota, *Sheldon* from Pipestone, Minnesota, collection of August, 1891, and many others.

13. *G. perennis* A. Nels. in Bull. Torr. Bot. Club **26**: 355. 1899; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909; Rydb. Fl. Rocky Mts. 848. 1917; Standl. in Contr. U.S. Nat. Herb. [Fl. Glac. Nat. Park] **22**: 421. 1921; Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. 1932.

G. squarrosa (Pursh) Dunal acc. to Torr. & Gray, Fl. N. Am. **2**: 247. 1842, in part; acc. to Macoun, Cat. Can. Pl. pt. 2. 208. 1884; acc. to Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, in part, at least as to plant of *Bourgeau*.

G. nana Nutt. acc. to Millsp. Field Mus. Publ. Bot. **3**: 97. 1904.

G. serrulata Rydb. \times *G. perennis* A. Nels., Daniels in U. Mo. Stud. [Fl. Boulder, Colo.] **2**: 227. 1911.

G. squarrosa var. *quasiperennis* Lunell, Am. Midl. Nat. **3**: 143. 1913.

Herbaceous biennial; stems one to usually several and subcaespitose, slender, corymbosely much branched, with ascending branchlets, usually rose-purple or sometimes stramineous, glabrous, 1–5 dm. tall; leaves typically thick and subcoriaceous, dull bluish- or grayish-green, abundantly punctate, entire to remotely serrulate (sometimes rather closely serrulate to coarsely serrate), the radical, lower, and sometimes the middle cauline often becoming irregularly coarsely incised-serrate or pinnatifid, the main middle and the upper cauline 3–6 cm. long, mostly 0.4–1 cm. broad (rarely 2 cm.), mostly 5–8 times longer than broad, at least the main cauline leaves narrowly oblong to oblanceolate, obtuse to acute, the lower mostly narrowed to the base, glabrous; heads radiate, averaging 2.2–3.3 cm. broad; disk hemispherical, 0.6–1.1 cm. high, mostly 0.7–1.6 cm. broad (sometimes up to 2 cm.); involucre bracts abundantly resinous, 4–5-seriate, the upper third to fourth strongly reflexed or revolute, 3–8 mm. long, the outer and middle bracts linear- to lanceolate-subulate with gradually attenuate apex, the free portion mostly subterete and subcoriaceous; receptacle conspicuously foveolate; rays 22–32, bright orange- to golden-yellow, lamina 7–15 mm. long; achenes oblong to narrowly oblong, 2.5–3.3 mm. long, 0.75–1.5 mm. broad, light or dark brown to stramineous, lightly stri-

ate, horizontally truncate at apex; awns 2-8, 1-5 mm. long, remotely to often moderately serrulate or setulose-serrulate, $\frac{1}{2}$ - $\frac{7}{8}$ length of disk-floret.

Distribution: desiccated ponds, alluvial soils along lake-shores and river-banks, short-grass high plains and northwestern prairie-plains, subsaline fields and desert flats, from southeastern British Columbia, northern Alberta, southern Saskatchewan, Northwest Territory, southern Manitoba, south to Montana, eastern Idaho, Wyoming, North Dakota, western South Dakota, and Minnesota, and introduced on Santa Catalina Island, California, and Yucatan, Central America.

UNITED STATES:

MINNESOTA: Crookston, Aug., 1900, *MacMillan & Skinner* (MU); Grand Rapids, Aug. 12, 1912, *Sandberg* 286 (MU).

NORTH DAKOTA: near Minot, July 30, 1903, *Waldron* 1853 (R); plains, Leeds, Sept. 8, 1908, and Butte, Aug. 2, 1909, *Lunell* 1040 (MU TYPE of *G. squarrosa* var. *quasiperennis*); Dickinson, Sept. 11, 1908, *Holgate* (CAS, G, NY, US); Alkabo, Aug. 18, 1928, *Larsen* 222 (M, NY); Maple Creek, Aug. 25, 1902, *Rosendahl* 1140 (MU); Valley City, 1897, *Fieldstad* (R); Moon Lake, Valley City, Aug. 3, 1917, *Mabbott* 204 (US).

SOUTH DAKOTA: Steppe, 12 mi. north of Crook, northwest Harding Co., July 23, 1910, *Visher* 375 (F, R); Cave Hills, July, 1925, *Moore* 1628 (MU); Bear Lodge Mts., Aug. 8, 1897, *Carter* (NY, R).

MONTANA: 6½ mi. southeast of Chouteau, alt. 1900 m., Aug. 16, 1931, *Moore & Steyermark* 3700 (M); canyons, Helena, July, 1892, *Aiton* (MU); Bridger Pass, Gallatin Co., Aug. 20, 1916, *Suksdorf* 51 (M); near Butte, alt. 5500-6000 ft., 1893, *Moore* (M); Helena, July 25, 1888, *Kelsey* (MU, N, US); low subsaline field in clay soil, 5 mi. north of Babb, Aug. 21, 1931, *J. T. Howell* 7882 (CAS); dry sandy soil, Teton River, alt. 3500 ft., Aug. 25, 1883, *Scribner* 72 (PA); uplands, Bozeman, Sept. 4, 1905, *Blankinship* 267 (F, PA, US); dry plains, Midvale, Aug. 7, 1903, *Umbach* 640 (F, MA, NY, US); Sedan, July 28, 1901, *B. I. Jones* (R); 2 mi. south of Livingston, Park Co., alt. 1800 m., Aug. 16, 1931, *Moore & Steyermark* 3699 (M); Park Co., 1901, *Scheuber* 9 (NY); near Bonner, Aug. 31, 1892, *Sandberg, MacDougal & Heller* 991 (G, NY, PO, US); near Thompson's Falls, Aug. 28, 1892, *Sandberg, MacDougal & Heller* 1036 (F, G, NY, PO, US); west of Ft. Benton, *Broadhead* (M); exsiccated pond, vicinity of Glacier Park station, alt. 1440-1530 m., Aug. 16, 1919, *Standley* 17760 (US); Harlowtown, July 24, 1921, *Wootton* (US).

YELLOWSTONE NATIONAL PARK: Mammoth Hot Springs, Sept. 13, 1902, *Mearns* 3939 (NY, US); Gardiner City, Aug. 21, 1902, *Mearns* 3489 (NY, US).

WYOMING: valley of the Big Horn River, Aug., 1859, *H. Engelmann* (M); valley of the Yellowstone River, 1860, *Hines* (M); Sweetwater River, July 27, 1898, *E. Nelson* 4988 (M, N, NY, R TYPE); Meadow Creek, Aug. 9, 1894, *A. Nelson* 777 (G, MU, R, COTYPES); Buffalo, alt. 4000-5000 ft., Sept., 1900, *Tweedy* 3147 (NY, R); Dayton, Sheridan Co., alt. 4000 ft., Sept., 1899, *Tweedy* 2077 (NY); Little Medicine River near the John Burnett Ranch, Aug., 1899, *Schuchert* (NY, US).

COLORADO: Georgetown, alt. 8300 ft., July 10, 1878, *M. E. Jones* 820 (PO); Steamboat Springs, Sept., 1891, *Trelease* (M); plains, Brighton, Sept. 30, 1908, *E. L. Johnston* 226a (M).

IDAHO: Big Lost River, 1896, *Henderson 3666* (US); Big Butte Station, Snake Plains, Aug. 12, 1893, *Ed. Palmer 500* (US); near Horse Plains, Clarks Fork Valley, in region of Coeur d'Alene Mts., alt. 640 ft., Aug. 24, 1895, *Leiberg 1586* (CAL, F, G, M, NY, PO, R, US).

UTAH: 20 miles west of Orangeville, Manti National Forest, alt. 1900 m., Aug. 26, 1931, *Moore & Steyermark 3769* (M); Ogden, Aug. 6, 1887 and July 31, 1887, *Tracy & Evans 546* (MA, NY); hills and mountains north of Salt Lake City, June 9 and 12, 1905, *Rydberg 6174* (NY, R).

CALIFORNIA: sandy soil, upper Middle Ranch canyon, Santa Catalina Island, Aug. 13, 1922, *Knopf 493* (F).

CANADA:

MANITOBA: roadsides and prairies, Brandon, July 27, 1896, *Macoun* (CAN, NY); abundant everywhere on grassy prairie and roadside, Birds Hill, Aug. 1, 1915, *Thompson 8* (M).

NORTHWEST TERRITORY: Little Buffalo River, on alkali flats near end of Salt-river trail, Wood Buffalo Park, Aug. 22, 1926, *Russell* (CAN); salt plains, Bear Spring, Aug. 19, 1931, *Raup* (CAN, G).

SASKATCHEWAN: plains, Moose Jaw, Sept. 2, 1909, *Moyer* (MU); Regina, Sept. 2, 1929, *Barham* (PO); "Saskatchewan," 1857-8, *Bourgeau* (G, NY); along the line of the Grand Trunk Pacific Railway, Aug. 2, 1906, *Macoun & Herriot* (CAN, G, NY).

ALBERTA: prairies and hills, Bow Valley, vicinity of Calgary, alt. 3400-3600 ft., July 19, 1913, *Moodie 27* (F, NY); dry prairie soil, Rosedale camp, vicinity of Rosedale, alt. 2200-2500 ft., Aug. 14, 1915, *Moodie 1203* (F, G, M, NY, US); Belly River, July 22, 1881, *Dawson* (CAN); Spray Valley, 9 mi. from Banff, Sept., 1927, *Sanson 1017* (NY).

BRITISH COLUMBIA: Fort Steele, Aug. 11, 1921, *Anderson* (NY); Glacier, Aug., 1895, *Schaffer* (PA).

CENTRAL AMERICA: YUCATAN—Merida, 1887, *Millsbaugh 33*, introduced (F).

This is the common and widespread plant of the high plains from the Northwest Territory, Saskatchewan, Manitoba, Alberta, and eastern British Columbia south into eastern Idaho, Montana, Wyoming, North Dakota, and western South Dakota. The extreme evaporation and desiccation caused by high winds and drought, together with subsaline soils, have combined, in the main, to produce a dwarfed type of herbaceous vegetation, a fact well manifest in *G. perennis*, which has been modified from the more luxuriant *G. squarrosa*. Delimited within this high-plains region of short grass *G. perennis* is quite distinct from the more eastern and southern *G. squarrosa*. The stems are much shorter (mostly 1-4 dm. tall) than in *G. squarrosa*, the heads are smaller and especially narrower, the involucre bracts more strongly reflexed or revolute, the main cauline

leaves narrower and entire or remotely serrulate, instead of regularly crenate-serrate as in *G. squarrosa*, the lower and basal leaves are often incised or pinnatifid, a condition not usually present in either *G. squarrosa* or var. *serrulata* although prevalent in *G. squarrosa* var. *nuda*, the achenes average smaller and narrower than in *G. squarrosa*, and the pappus awns are usually more strongly serrulate or setulose-serrulate. Very often, however, difficulties arise in distinguishing *G. perennis* near its southern, eastern, and western limits of dispersal from *G. squarrosa* var. *serrulata*. In several respects the latter is intermediate between *G. squarrosa* and *G. perennis*, although it manifests greater affinity with the former. In parts of South and North Dakota, southern Wyoming, Colorado, western Minnesota, eastern Idaho, and adjacent territory, hybridization between *G. perennis* and *G. squarrosa* var. *serrulata* probably occurs, especially at or near the margins of the natural ranges in the zone of range overlap. Among collections intermediate between *G. squarrosa* var. *serrulata* and *G. perennis* may be cited *Visher 603*, *Lunell 376*, *Lakela 410*, *Bolley* from Leeds, North Dakota, *Hayward 12*, *A. Nelson 9042* and *1148*, and many others.

Grindelia perennis might be considered a strong variety of *G. squarrosa*, but the writer believes it best at present to retain it as a separate species. It might be added that in growing many plants of *G. perennis* from seeds, the distinctive morphological and habital characters have persisted, even the dwarfed habit, which at least indicates that such characters are definitely genetically tied up with the plant and are not mere tendencies of ecological variation. Similarly, *G. squarrosa* and var. *serrulata* have upon cultivation retained their morphological characteristics of broader or narrower leaves.

14. *G. oxylepis* Greene, Pitt. 4: 42. 1899.

G. arizonica Gray acc. to Gray in Proc. Am. Acad. 17: 208. 1882, as to plant of *Palmer 467*; acc. to Wats. in Proc. Am. Acad. 18: 101. 1883; acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, only as to plants from Mexico; acc. to Hemsl. Biol. Cent.-Am. Bot. 4: 52. 1886.

G. squarrosa (Pursh) Dunal acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to plants from Mexico.

Stems 1 to few from a subherbaceous base, slender, glabrous, 2–5.5 dm. tall; leaves numerous, subcoriaceous or firm, dark olive-green, moderately resinous-punctate, rather remotely crenulate- or sinuate-serrulate to remotely serrate with obtusish mostly resinous-tipped teeth, lower cauline and basal irregularly and coarsely incised-dentate, the main cauline 1–3 cm. long, 3–8 mm. broad (those on floriferous branchlets gradually reduced), $2\frac{1}{2}$ – $4\frac{1}{2}$ times longer than broad, oblong, mostly obtuse or acute, subamplexicaul; heads radiate, 1.5–2.5 cm. broad; disk depressed-hemispherical, the sides distending downward in fruit, 0.7–1 cm. high, 0.8–1.6 cm. broad; involucre moderately and rather conspicuously resinous, mostly 4-seriate, the bracts 4–8 mm. long, lanceolate with acuminate to short subulate tips, glabrous, the free portion somewhat reflexed or spreading; the rays 20–30, dull yellow, the lamina 7–9 mm. long; achenes oblong, 1.5–3 mm. long, 1–1.5 mm. broad, amber to chestnut-brown, when mature finely but conspicuously and irregularly wrinkled-rugose, horizontally truncate at apex, mostly quadrangular or subquadrangular, the apex rounded with a smoothish border; awns 2–3 to the floret, capillary-linear, entire or subentire, 4–6 mm. long, equalling or nearly equalling length of disk-floret.

Distribution: moist places on plains, valleys, and old fields, State of Chihuahua, northern Mexico, south to State of San Luis Potosi, central Mexico.

MEXICO:

COAHUILA: plains near Filipinas, Oct., 1910, *Purpus 4701* (CAL, G, M, US); States of Coahuila and Nuevo Leon, Feb.–Oct., 1880, *Ed. Palmer 467* (G, PA, US).

CHIHUAHUA: plains near Chihuahua, Aug. 30, 1885, *Pringle 589* (G, US); wet places, plains near Chihuahua, Sept. 17, 1886, *Pringle 748* (CAL, G, M, MA, MU, NY, PA, R, US TYPE); Sta. Eulalia Plains, Aug. 25, 1885, *Wilkinson* (US).

DURANGO: in old cornfields at city of Durango and vicinity, June (April–Nov.), 1896, *Ed. Palmer 174* (CAL, G, M, NY, US); moist valley, Bolso de Mapimi, April 13 and 14, 1847, *Gregg 444* (M, NY).

SAN LUIS POTOSI: in the region of San Luis Potosi, 22° N. Lat., alt. 6000–8000 ft., 1878, *Parry & Palmer 371* $\frac{1}{2}$ (G); San Luis Potosi, 1879, *Schaffner 308* (NY, US); ex convalli San Luis Potosi, in paludosis prope San Pedro, Sept., 1876, *Schaffner 308* in part (G); ex convalli San Luis Potosi, 1877, *Schaffner 308* (NY).

14a. f. capitellata Steyermark, f. nov.¹⁹

Heads smaller; disk small, campanulate-hemispherical to campanulate, 0.5–0.7 cm. high, 0.5–0.7 cm. broad in anthesis, becoming 1–1.3 cm. broad in fruit.

Distribution: vicinity of Mapimi, State of Durango, Mexico.

MEXICO: DURANGO—Mapimi and vicinity, Oct. 21–23, 1898, *Ed. Palmer 520* (CAL, G TYPE, M, NY, US).

14b. var. eligulata Steyermark, var. nov.²⁰

Leaves rather regularly crenulate-serrulate to remotely crenulate or sinuate-serrulate, oblong, obtuse; heads discoid; bracts averaging longer, linear to lanceolate with more attenuate or subulate, subterete, thickened tips 2.5–3.3 mm. long.

Distribution: vicinity of Saltillo and San Antonio, State of Coahuila, north-eastern Mexico.

MEXICO: COAHUILA—Saltillo and vicinity, Sept., 1898, *Ed. Palmer 316* (CAL, G TYPE, M, NY, US); Saltillo, alt. 5300 ft., Aug. 16, 1930, *Fisher* (CAS); San Antonio, Aug. 31, 1848, *Gregg 354* (G, M); near Saltillo, July 6, 1848, *Gregg 233* (M); valley near Saltillo, June 2, 1848, *Gregg 97* (G, M).

The small quadrangular achenes become upon full maturity finely wrinkled-rugose, whereas immature achenes show only slight irregularities on the surface.

15. *G. aphanactis* Rydb. in Bull. Torr. Bot. Club **31**: 647. 1904; in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 339. 1906; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 654. 1915; Rydb. Fl. Rocky Mts. 849. 1917; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 534. 1925, as to synonym and plant from San Juan River.

G. squarrosa (Pursh) Dunal acc. to Gray in Mem. Am. Acad. N. S. **41**: 77. 1849.

¹⁹ ***G. oxylepis* f. capitellata** Steyermark, f. nov., capitulis parvioribus quam specie; disco 0.5–0.7 cm. alto, 0.5–0.7 cm. lato, in fructu 1–1.3 cm. lato.—Collected at Mapimi, State of Durango, Mexico, Oct. 21–23, 1898, *Ed. Palmer 520* (Gray Herb. TYPE, CAL, M, NY, US, isotypes).

²⁰ ***G. oxylepis* var. eligulata** Steyermark, var. nov., foliis plus minusve regulariter vel remote crenulato-serrulatis vel sinuato-serrulatis, oblongis, obtusis; capitulis discoideis; bracteis involucri patentibus vel paullum reflexis, linearibus vel lanceolatis, apicibus liberis et attenuatioribus quam specie vel subulatis, 2.5–3.3 mm. longis, subteretibus, crassescenscentibus.—Collected at Saltillo, State of Coahuila, Mexico, Sept., 1898, *Ed. Palmer 316* (Gray, Herb. TYPE, CAL, M, NY, US, isotypes).

G. squarrosa (Pursh) Dunal var. *nuda* (Wood) Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, only as to plants of *Fendler 390* and *Vasey*.

G. fastigiata Greene acc. to Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909, in large part; acc. to Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] 25: 534. 1925, as to plant from San Juan River.

G. pinnatifida Woot. & Standl. in Contr. U. S. Nat. Herb. 16: 178. 1913; in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 654. 1915.

Herbaceous biennial; stems one to several, mostly slender, corymbosely much-branched with ascending, often elongated branchlets, stramineous to reddish-purple, glabrous, 1.5–9 dm. tall, uniformly leafy throughout; leaves firmly membranaceous to submembranaceous, slightly to moderately resinous-punctate, extremely variable in serration, the upper and middle cauline entire, crenulate-serrate or denticulate to coarsely crenate-serrate, the lower and basal crenate to frequently pinnatifid, the main cauline 2.5–7 cm. long, 0.25–1.2 cm. broad, mostly oblong or oblanceolate, 5–10 times longer than broad, obtuse or acute, the middle and upper subamplexicaul, glabrous except for the minutely scabridulous margin; heads discoid; disk quadrate- or campanulate-hemispherical, 0.7–2 cm. high, 1–2.8 cm. broad, broader than long; involucre moderately to slightly resinous, mostly 5–6-seriate, the upper third to half of the bracts loosely or moderately reflexed, 4–12 mm. long, linear to lanceolate with subulate tips, glabrous; achenes mostly quadrate-oblong, 2.3–3 mm. long, 1.5–2.2 mm. broad, mostly fulvous- to chestnut-brown, often quadrangular in maturity, deeply furrowed or ribbed, the ridges sometimes rugulose, mostly horizontally truncate at apex, or sometimes constricted into a shallow crown; awns 2–3 to the floret, slender, subentire to moderately setulose-serrulate, 3–5.5 mm. long, $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: moist or dry meadows, fields, roadsides, rocky or sandy bars or beds along streams in valleys or canyons in the mountains, mostly in and west of the Cordilleran Range from extreme southeastern Utah and southern Colorado, New Mexico, extreme western Texas and central and eastern Arizona.

TEXAS: along road to Toyahvale, 20 miles from Ft. Davis, Jeff Davis Co., Davis Mts., alt. 1240 m., June 10, 1931, *Moore & Steyermark 3010* (M); *Havard* (US).

COLORADO: southwest Colorado, 1875, *T. S. Brandege* (CAL); Cortez, Montezuma Co., alt. 1830 m., Aug. 27, 1931, *Moore & Steyermark 3775* (M); *Artemisia* belt, Coal Dale, Fremont Co., alt. 1860 m., Aug. 30, 1931, *Moore & Steyermark 3782* (M); on dry gravelly soil, Durango, July 21, 1898, *C. F. Baker, F. S. Earle, & S. M. Tracy 526* (F, G, M, MU, NY, PO, R, TYPE collection).

NEW MEXICO: Albuquerque, Sept. 4, 1884, *M. E. Jones 4140* (CAL, CAS, F, MA, NY, PO, R, US); moist field, near Sitting Bull Falls, Guadalupe Mts., Aug. 12-20, 1924, *Standley 40708* (US); Española, Santa Fe to Las Vegas, Sept. 7, 1881, *G. Engelmann* (M); Taos, Sept. 7, 1929, *Whitehouse 7358* (B); Sandia Mts., June-Aug., 1914, *Ellis 85* (M, NY, US); Santa Fe Creek, 1847, *Fendler 390* (CAL, G, M, PA, US); vicinity of Las Vegas, San Miguel Co., Sept., 1919, *Bro. Anect 12* (CAS, G); Socorro, July, 1881, *Vasey* (G, US); Santa Fe, alt. 7200 ft., July 8, 1897, *A. A. & E. G. Heller 3828* (M, MA, MU, NY, US); dry hillside, vicinity of Ensenada, Rio Arriba Co., Aug. 24, 1914, *Standley & Bollman 10746* (US).

ARIZONA: Chiricahua Mts., Aug. 1, 1881, *Lemmon* (CAL); Adamana, Sept. 2, 1909, *Rusby* (NY); northeastern Arizona (Moki Reservation) and Little Colorado River, Aug. 1-Sept. 5, 1896, *Hough 106* (US); roadside near Prescott, Yavapai Co., alt. 1710 m., Aug. 2, 1931, *Moore & Steyermark 3682* (M); Holbrook, June 28, 1896, *Zuck* (US).

UTAH: along San Juan River, near Bluffs, alt. 1200-1500 m., Aug. 25-29, 1911, *Rydberg & Garrett 9999* (CAL, NY, R, US).

This species is quite variable in its leaf margins; these may range from entire to pinnatifid, the latter condition frequently occurring in the lower leaves. Upon this pinnatifid character, Wootton and Standley attempted to differentiate *G. pinnatifida*. However, this name must fall into synonymy, not only because much of the type collection (*Baker, Earle, and Tracy 526*) exhibits basal leaves which are pinnatifid or incised, but also because a study of a large series of specimens reveals the fact that the leaf outline is extremely variable, even on the same plant, and tendencies towards deep leaf incision are not to be relied upon for specific or varietal differentiation.

The involucre bracts are more strongly reflexed than in *G. squarrosa* var. *nuda*, but not at all strongly revolute and thickened as in *G. fastigiata* or *G. inornata*. From narrow-leaved forms of *G. squarrosa* var. *nuda*, such as f. *angustior*, *G. aphanactis* may be distinguished by its more markedly serrulate or setulose-serrulate pappus awns, more strongly reflexed involucre bracts, more deeply ribbed or furrowed achenes, and less regularly crenulate-serrate leaf margins.

Some tall-branching specimens of this species, as, for example, *Rydberg and Garrett 9999* from San Juan River, Utah, have been mistaken for *G. fastigiata*, but that species has more deeply campanulate exceedingly resinous heads with strongly revolute bracts.

Wooton and Standley's collections in the Organ Mts., New Mexico, obtained Sept. 20, 1908, and Sept. 23, 1906, are intermediate between *G. aphanactis* and *G. squarrosa* var. *nuda* or f. *angustior*. Hybridization may occur between these last entities where the margins of ranges overlap along the western Texas-New Mexico boundary.

16. *G. fastigiata* Greene, Pitt. **3**: 102, 1896; Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 339. 1906; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909, as to name only; Rydb. Fl. Rocky Mts. 848. 1917; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 534. 1925, as to name, not as to plant from San Juan River.

Herbaceous perennial; stems strict, several, stoutish, fastigiate-ly branched above with closely ascending elongated branchlets, stramineous, glabrous, 0.5–1.5 m. tall; leaves thick and subcoriaceous, light green, moderately to conspicuously punctate, entire or remotely denticulate or dentate to closely serrate, the main cauline 1.5–13 cm. long, mostly 1–1.8 cm. broad, 3–8 times longer than broad, oblanceolate to oblong-spatulate, or (the upper) chiefly oblong, obtuse to acute, glabrous; heads discoid; disk mostly deeply campanulate, as long as or longer than broad (campanulate-hemispherical before anthesis), 1.0–1.4 cm. high, 0.9–1.7 cm. broad; involucre about 6-seriate, bracts 3–9 mm. long, lanceolate to linear-lanceolate with short subulate tips, glabrous, terete, only the upper third to fourth free with closely and strongly revolute, thickened, subcoriaceous tips; receptacle conspicuously foveolate; stigmas linear-lanceolate; achenes oblong, 3.5–5 mm. long, 1.3–1.7 mm. broad, dark fulvous or chestnut-brown, slightly nerved, rather irregularly bordered with faint projections; awns 2–3, slender, remotely to moderately serrulate, 3–5.5 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ length of floret.

Distribution: dry places in open desert, arid, dry, open sandbars along rivers, southeastern Utah and adjacent western Colorado.

COLORADO: Grand Junction, alt. 1375 m., Sept. 15, 1901, *Underwood & Selby 504* (NY); Grand Junction, Aug., 1901, *Hedgcock* (M); De Beque, Mesa Co., Aug. 22, 1918, *Osterhout 5839* (R); Grand Junction, Aug. 27, 1896, *Greene* (N TYPE).

UTAH: in sand along Colorado River near Moab, Grand Co., alt. 920 m., Aug. 27, 1931, *Moore & Steyermark 3771* (M); on desert near roadside, 5 miles east of Woodside, Emery Co., alt. 1220 m., Aug. 26, 1931, *Moore & Steyermark 3770* (M); Lower Crossing, alt. 4500 ft., July 2, 1898, *M. E. Jones* (PO); Moab, Aug. 30, 1891, *M. E. Jones* (PO); Green River, Nov. 3, 1915, *M. E. Jones* (CAS, PO).

This little-known species is one of several which are limited to the Grand Junction region of southwestern Colorado and the region immediately westward in eastern Utah, an area apparently of great endemism for many species of flowering plants. The plants of *G. fastigiata* attain a height of 1.5 meters, and the elongate subfastigiate floriferous branchlets, deeply campanulate disk covered with conspicuously graduated strongly resinous bracts with coriaceous revolute tips, and subcoriaceous resinous leaves, combine to stamp this as a very distinct discoid species.

17. *G. inornata* Greene, Pitt. **3**: 102. 1896; Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909, as synonym of *G. fastigiata*; Rydb. Fl. Rocky Mts. 848. 1917.

Herbaceous perennial; stems several, stoutish, subcorymbosely to paniculately branched above with ascending branchlets, stramineous, glabrous, 2.5–8 dm. tall; leaves subcoriaceous, pale olive-green, slightly punctate, finely to coarsely dentate, the teeth sharply acute to subspinulose, sometimes the upper leaves toothed only about the apex, the main cauline 2–5.5 cm. long, 1.2–2.2 cm. broad, $1\frac{1}{2}$ –3 times longer than broad, of same breadth throughout or somewhat broader at base, obtuse or obtusish, mucronate, ovate to broadly oblong, the lower often obovate-oblong, glabrous (minutely scabridulous on margins); heads discoid; disk campanulate-hemispherical, mostly broader than long, 0.8–1.2 cm. high, 1–2 cm. broad; involucre moderately to exceedingly resinous, mostly 5–6-seriate, the bracts 5–10 mm. long, lanceolate-subulate, glabrous, the upper third to fourth strongly reflexed, subterete

and thickened; achenes oblong, mostly 3–5 mm. long, about 1.5 mm. broad, stramineous to pale brown, lightly striated or smooth, apex horizontally truncate, sometimes constricted below into a conspicuous brim; awns 2–3 to the floret, slender,

Fig. 13. *G. oxylepis*. $\times \frac{1}{6}$.Fig. 14. *G. inornata*.
 $\times \frac{1}{6}$.Fig. 15. *G. revoluta*. $\times \frac{1}{6}$.

remotely serrulate to setulose-serrulate, 3.5–4.5 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: dry hillsides and slopes, southeastern Colorado east of the Continental Divide around Cañon City, Florence, and Pike's Peak region.

COLORADO: dry soil, 5 mi. east of Florence, Fremont Co., alt. 1575 m., Sept. 2, 1921, *Clokey 4323* (CAS, F, M, MU, NY, PA, PO, R, US); Cañon City, Fremont Co., 1871 and 1872, *T. S. Brandegees 326* (CAL, M); dry hills, Cañon City, alt. 1620 m., Sept. 2, 1921, *Clokey 4325* (CAS, F, M, NY, PA, PO, R, US); Cañon City, Sept., 1896, *Greene* (N TYPE); by road up Pike's Peak, Aug. 19, 1933, *Naylor* (MO).

17a. var. *angusta* Steyermark, var. nov.²¹

Main middle and upper cauline leaves 3–7 cm. long, 0.8–2 cm. broad, mostly $3\frac{2}{3}$ –6 times longer than broad, oblong, linear-oblong to oblong-oblongate, acute to acutish.

Distribution: east-central Colorado from vicinity of Denver south to Pueblo and west to vicinity of Cañon City, Fremont Co.

COLORADO: 12 miles west of Cañon City, Fremont Co., alt. 2140 m., Aug. 30, 1931, *Moore & Steyermark 3783* (M); clay soil, Barnum, Aug. 28, 1910, *Eastwood 63* (CAL, CAS, G, US); Barnum, Sept. 14, 1916, *Bethel* (CAS); prairie, Denver, Denver Co., alt. 1605 m., Aug. 27, 1921, *Clokey 4324* (D, M, MU, NY, PA, R, US); Colorado Springs, 1903, *Shantz 597* (US TYPE); Colorado Springs, Dec., 1903, *Shantz 595* (US); Broadmoor, Colorado Springs, Aug. 14, 1900, *E. T. & S. A. Harper* (F, M); Colorado Springs, alt. 1900 m., Sept., 22, 1915, *Eggleston 12029* (US); Colorado Springs, July 11, 1901, *Williamson* (PA); Cheyenne Cañon, Aug. 21, 1915, *Drushel* (M).

Grindelia inornata is closely related to the preceding, from which it may be distinguished by the shorter stems which are subcorymbosely or paniculately, but not subfastigiately, branched, by the more sharply dentate leaves having more saliently acute to subspinulose teeth, and by the campanulate-hemispherical disk which is generally broader than long, whereas in *G. fastigiata* it is mostly (when fully mature) longer than broad.

This species, which is rather uncommon, is apparently localized to the region around Cañon City and Florence, in Fremont Co., Colorado, a region of marked endemism.

18. *G. revoluta* Steyermark, sp. nov.²²

G. squarrosa (Pursh) Dunal acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to plant of *Greene 15 & 16* only.

²¹ *G. inornata* var. *angusta* Steyermark, var. nov., foliis caulinis mediis et superioribus 3–7 cm. longis, 0.8–2 cm. latis, oblongis, lineari-oblongis vel oblongo-oblongatis, acutis vel acuminatis.—Collected at Colorado Springs, Colorado, 1903, *H. L. Shantz 597* (U. S. Nat. Herb. no. 835610 TYPE).

²² *G. revoluta* Steyermark, sp. nov., caulibus 5–8 dm. altis; foliis subcoriaceis, integris vel plerumque regulariter dentatis vel denticulatis cum dentibus brevibus

Herbaceous; stems stout, mostly subpaniculately or corymbosely branched above, stramineous or buff, sometimes suffused with rose-purple, glabrous, 5–8 dm. tall; leaves subcoriaceous, dark or pale olive-green, moderately resinous-punctate, entire or more often regularly dentate or denticulate with rather short broad teeth, the main middle and lower cauline 4–7.5 cm. long, 1.3–3 cm. broad, $2\frac{1}{2}$ –5 times longer than broad, mostly broadly oblong, obtuse to acutish, the main cauline subamplexicaul, of about equal breadth from base to apex, the upper leaves subamplexicaul to strongly clasping, glabrous except for the scabridulous margin; heads radiate, 2–3.5 cm. broad; disk campanulate-hemispherical to depressed-hemispherical, 1–1.3 cm. high, 1.3–2.5 cm. broad; involucre abundantly and conspicuously resinous, about 5-seriate, the upper fourth to third of the bracts strongly reflexed to mostly revolute, 4–10 mm. long, linear-lanceolate to lanceolate with subulate tips, the free revolute portion terete, thickened, and subcoriaceous; receptacle conspicuously foveolate with rather elongated acute projections; rays 21–37, short, the lamina 4–11 mm. long; achenes oblong, 3.5–4 mm. long, about 1.5 mm. broad, slightly striated, horizontally truncate at apex; awns 2 to the floret, slender, remotely serrulate to setulose-serrulate, 3.5–5 mm. long, about $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: dry open ground, along roadsides, etc., central Colorado just east of the slopes of the Rockies from El Paso Co. south to northern Huerfano Co.

COLORADO: along roadside, 14 mi. south from Colorado Springs, El Paso Co., alt. 1830 m., Aug. 30, 1931, *Moore & Steyermark 3784* (M TYPE); Cañon City, 1874, *T. S. Brandegees* (M); bed of D. & R. G. Railway, Pueblo, Pueblo Co., July, 1874, *T. S. Brandegees* (CAL); Pueblo, Sept. 18, 1873, *Greene 15 & 16* (G); Pueblo, 1883, *Woodward* (G[Woodward Herb.]); Colorado Springs, alt. 6000 ft., Sept. 19–21, 1895, *Clarke* (NY); Williams Cañon, Manitou, Aug. 10, 1900, *E. T. & S. A. Harper*

et latis, caulinis principalibus mediis et inferioribus 4–7.5 cm. longis, 1.3–3 cm. latis, $2\frac{1}{2}$ –5 plo longioribus quam latis, plerumque late oblongis et obtusis, caulinis superioribus et illis in ramusculis floriferis oblongis vel ovato-lanceolatis; disco campanulato-hemispherico, 1–1.3 cm. alto, 1.3–2.5 cm. lato; involucro abundanter et conspicue resinoso, bracteis plerumque revolutis, parte libera terete et subcoriacea; aristis 2 in disci flore, remote serrulatis vel setuloso-serrulatis.—Collected along roadside, 14 miles south from Colorado Springs, El Paso Co., Colorado, alt. 1830 m., Aug. 30, 1931, *J. A. Moore & J. A. Steyermark 3784* (Mo. Bot. Gard. Herb. no. 1027335 TYPE).

(F, M); sandy prairie 5 mi. east of Peyton, El Paso Co., alt. 1900 m., Aug. 31, 1931, *Moore & Steyermark 3785* (M); sandy creek bottom, Huerfano Valley, near Gardner, alt. 7000 ft., Sept. 10, 1900, *Freeland 663* (NY, R).

This species may be considered as the probable radiate equivalent and ancestor of the discoid *G. inornata*. It occupies a limited area around central Colorado in the Cañon City-Colorado Springs region, an area shared with *G. inornata*. In addition to its radiate heads, *G. revoluta* may be distinguished from *G. inornata* by its broader leaves marked with broader and shallower dentation. Some specimens show but a slight development of rays, and it would be but another step towards the reduction of rays to effect abortion to a discoid condition as obtains in *G. inornata*.

19. *G. acutifolia* Steyermark, sp. nov.²³

G. subalpina Greene acc. to Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915, as to specimens from New Mexico.

G. texana Scheele acc. to Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915, as to specimen from Raton, New Mexico.

Herbaceous; stems several, corymbosely branched above with spreading-ascending branchlets, buff or stramineous to reddish-purple, glabrous, 4–8 dm. tall; leaves firmly membranaceous, light grass or olive-green, saliently and sharply dentate or serrate with acute to setulose-acuminate teeth or sometimes (the uppermost) entire, the main middle and lower cauline 2.5–8.5 cm. long, 0.7–3 cm. broad, 4–5 times longer than broad, oblong or oblanceolate to lanceolate or ovate-lanceolate, the upper strongly subamplexicaul, mostly glabrous (except for the scabridulous margins); heads radiate, 2.5–3.5 cm.

²³ *G. acutifolia* Steyermark, sp. nov., caulibus supra corymboso-ramosis, 4–8 dm. altis; foliis firme membranaceis, salienter dentatis vel serratis cum dentibus acutis vel setuloso-acuminatis, illis in ramusculis floriferis integris vel serratis, caulinis principalibus mediis et inferioribus 2.5–8.5 cm. longis, 0.7–3 cm. latis, 4–5 plo longioribus quam latis, oblanceolatis vel oblongis, caulinis superioribus lanceolatis vel ovato-lanceolatis, valde amplexicaulibus, plerumque glabris; bracteis involucri plerumque valde revolutis; aristis 2–3, remote serrulatis vel numerose serrulatis.—Collected on Johnson's Mesa, New Mexico, Aug. 16, 1910, *E. O. Wooton* (U. S. Nat. Herb. no. 663251 TYPE).

broad; disk campanulate-hemispherical, 1.2–1.5 cm. high, 1.4–2 cm. broad, involucre moderately resinous, 5–6-seriate, the upper fourth to half of the bracts strongly revolute, terete and thickened, 3.5–10 mm. long, linear-lanceolate to lanceolate with rather long subulate tips; receptacle conspicuously foveolate; rays 18–25, the lamina about 9–11 mm. long; achenes oblong, 4–5 mm. long, 1.5–2 mm. broad, stramineous or light brown, slightly striated on faces, horizontally truncate at apex; awns 2–3 to the floret, remotely serrulate to numerously serrulate, 3.8–5 mm. long, about $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: dry open slopes and dry ground, southeastern Colorado in vicinity of Trinidad, to northeastern New Mexico in vicinity of Raton.

COLORADO: Wooten, Sept. 11, 1909, *Rusby* (NY); Trinidad, July, 1915, *Beckwith* 218 (NY); foot of Raton Pass, near Morley, Las Animas Co., Aug. 29, 1921, *Ferris & Duncan* 3538 (ST).

NEW MEXICO: canyons, vicinity of Raton, Colfax Co., alt. about 2100–2380 m., June 21 and 22, 1911, *Standley* 6326 (US); Goat Mt., Raton, Aug., 1900, *W. A. & T. D. A. Cockerell* (US); Johnson's Mesa, Aug. 16, 1910, *Wooten* (US TYPE); Raton, Aug. 29, 1900, *Cockerell* (R); dry hillside, vicinity of Raton, Colfax Co., alt. about 2020 m., Aug. 18, 1916, *Standley* 13291 (US); on the Colorado-New Mex. line, Raton Pass, Aug. 30, 1931, *Nelson* 11745 (M).

This species is an endemic in the Raton Mesa region along the Colorado-New Mexico boundary. It has been mistaken for *G. subalpina* and var. *erecta* by several authors, but is chiefly distinguished from both by having 2–3, instead of 4–8, pappus awns to the floret. The awns in *G. acutifolia* have shorter teeth or setae than those in *G. subalpina*, in which the setae are very prominent because of length and number.

20. *G. subalpina* Greene, Pitt. 3: 297. 1898; Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 489. 1909, excluding plants from Montana; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 655. 1915, as to name only; Rydb. Fl. Rocky Mts. 848. 1917, excluding plants from Montana, New Mexico, Utah, and British Columbia; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] 25: 535. 1925, as to name only.

G. platylepis Greene, Pitt. 3: 297. 1898; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 489. 1909, as synonym; Rydb. Fl. Rocky Mts. 847. 1917.

G. eldora Daniels in U. Mo. Stud. [Fl. Boulder, Colo.] 2: 227. 1911; Rydb. Fl. Rocky Mts. 848. 1917, as probable synonym.

Herbaceous biennial to perennial; stems several, subcaespitose, slender, much corymbosely branched with strongly ascending many-flowered branchlets, stramineous to suffused with reddish-purple, glabrous 1.5–3.5 (rarely 4) dm. tall; leaves submembranaceous, light green, mostly serrulate to dentate,



Fig. 16. *G. acutifolia*. $\times \frac{1}{5}$.



Fig. 17. *G. subalpina*. $\times \frac{1}{5}$.

the basal cauline often coarsely or incised serrate or dentate, the upper and middle cauline sometimes entire or serrate only near apex, the main cauline 1.5–6 cm. long, 0.3–1.5 cm. broad, 3–7 times longer than broad, mostly oblanceolate-oblong to lanceolate-oblong and sometimes narrowed to the sessile base, acute to obtuse, glabrous except for the minutely scabridulous margin; heads radiate, numerous, mostly 2.2–3.8 cm. broad; disk quadrate-hemispherical, 0.8–1.1 cm. high, 1–2 cm. broad; involucre moderately to slightly resinous, 5–6-seriate, the up-

per third to fourth of the bracts free and moderately reflexed, 4–10 mm. long, linear- or oblong-lanceolate to (the inner) lanceolate with acuminate or gradually tapering subulate tips, glabrous; receptacle conspicuously foveolate; rays 18–27, oblong-spatulate or elliptic-oblong, obtuse, the lamina 11–14 mm. long; achenes oblong, 2.5–3.5 mm. long, 1–1.5 mm. broad, light brown to stramineous, smooth or slightly striated especially on the angles, horizontally truncate at apex; awns 4–8, slender, acute, tapering gradually at the apex, mostly numerous setulose, 3.5–5.5 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ the length of the disk-floret.

Distribution: dry, open sandy or gravelly slopes, ridges, open valley, and creek bottoms, or waste ground, about the eastern slope of the central Rockies in southeastern Wyoming and adjacent east-north-central Colorado.

WYOMING: Laramie, July 9, 1896, *Greene* (N TYPE of *G. subalpina*); sandbars, Laramie, July 27, 1913, *Macbride 2562* (M); river bottoms, Encampment, Carbon Co., alt. 7200 ft., July 10, 1901, *Tweedy 4016* (NY, US); Wyoming University Campus, July 29, 1891, *Buffum 398* (R part of TYPE collection of *G. platylepis*); dry ground, 15 mi. southwest of Laramie, Aug. 22, 1901, *Merrill & Wilcox 1168* (G, NY, R, US); sandy bottom-lands, Dunn's Ranch, Albany Co., July 18, 1900, *A. Nelson 7615* (G, M, MU, NY, PO, R, US); Sherman, July 29, 1893, *Greene* (N TYPE collection of *G. platylepis*); Sand Creek, Albany Co., July 29, 1929, *J. M. & M. T. Greenman 6032* (M); Laramie, July, *Buffum* (N TYPE collection of *G. platylepis*); stony ridges, Laramie, Albany Co., Aug. 20, 1900, *A. Nelson 8080* (G, M, MU, NY, PO, R, US).

COLORADO: Fort Collins, alt. 5500 ft., July 7, 1884, *Sheldon 6* (US); Allenspark, July 16, *Johnston & Hedgcock 314* (R); top of Lookout Mt., Golden, Aug. 28, 1916, *Johnston 226a* (NY, US); near Boulder, alt. about 1700 m., July 18, 1905, *Ramaley 1284* (R); Netherlands, Aug., 1925, *Graves 2237* (M); from the headwaters of Clear Creek and the alpine ridges lying east of "Middle Park," 1861, *Parry 48* (F, G, M, PA).

20a. var. *erecta* (A. Nels.) Steyermark, comb. nov.

G. erecta A. Nels. in Bull. Torr. Bot. Club **26**: 356. 1899; Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906, excluding plant from Cerro Summit; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 489. 1909; Daniels in U. Mo. Stud. (Fl. Boulder, Colo.) **2**: 227. 1911; Rydb. Fl. Rocky Mts. 848. 1917.

G. squarrosa (Pursh) Dunal acc. to Porter & Coult. Syn. Fl. Colo. 67. 1874, as to plant of *Hall & Harbour 286*.

G. serrulata Rydb. acc. to Daniels in U. Mo. Stud. [Fl. Boulder, Colo.] **2**: 227. 1911.

G. subalpina Greene acc. to Daniels in U. Mo. Stud. [Fl. Boulder, Colo.] 2: 227. 1911, as to plant of *Daniels* 845.

G. texana Scheele acc. to Rydb. Fl. Rocky Mts. 848. 1917, as to plant of *Osterhout* 2410 from Lower Boulder Canyon; acc. to Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906.

Stem usually one from an herbaceous base, rather stout, corymbosely much-branched with strongly ascending many-flowered branchlets, 3.5–6.5 dm. tall; the lower and middle cauline leaves tending towards coarser and more incised dentation, the upper 1.5–6 cm. long, the others 6–15 cm. long, 1–3.5 cm. broad, mostly $1\frac{1}{2}$ –5 times longer than broad, the upper cauline oblong, oblanceolate- or elliptic-oblong to ovoid, the lower and middle broadly oblanceolate to spatulate- or obovoid-oblong, obtuse to acute, the basal tapering to a petiolate base, the upper and especially those on the floriferous branches subamplexicaul; heads mostly 3.5–4.5 cm. broad; disk 0.9–1.5 cm. high, 1–2.5 cm. broad.

Distribution: open plains and slopes about the eastern foothills of the central Rockies in southeastern Wyoming and adjacent east-north-central Colorado.

WYOMING: Blackwater, Platte, 1856, *Engelmann* (G); Laramie, July, *Buffum* (MU); Dale Creek, near Sherman, July 29, 1884, *Letterman* (M); Laramie Hills, Sept. 11, 1898, *A. Nelson* 5395 (G); sandy draws, Hallock Cañon, July 4, 1900, *A. Nelson* 7435 (R).

COLORADO: plains about Boulder, alt. 5600 ft., July 11, 1906, *Daniels* 385 (MO); road to Boulder, Ward, Aug. 29, 1917, *Johnston & Hedgcock* 215 (R); subalpine valley, Eldora, alt. 8600 ft., Aug. 31, 1906, *Daniels* 845 (MO); dry soil, Eldora, Boulder Co., alt. 2575 m., Sept. 13, 1921, *Bethel, Willey & Clokey* 4321 (CAS, F, M, MU, NY, PA, PO, R, US); open granite hillsides, Cherokee Park, July 29, 1923, *A. Nelson* 10003 (CAL, M); open slopes, Bald Mt., near Ward, alt. about 9500 ft., Aug. 7, 1921, *Hanson* C 127 (M); Lower Boulder Cañon, Boulder Co., Aug. 29, 1901, *Osterhout* 2410 (NY); Georgetown, Aug. 19, 1895, *Shear* 4705 (NY).

Greene was quite indiscriminate in giving the name “subalpina” to this species, since, like every other *Grindelia* of the United States and Canada, it does not inhabit the truly subalpine zone as that zone is generally understood.

A. Nelson’s *G. erecta* may be considered no more than a variety of *G. subalpina* with which it intergrades. The two entities occupy a similar range; *G. subalpina* var. *erecta* represents only a more robust phase with stouter taller solitary

stems, larger leaves, of which the upper are more clasping at the base, and usually with larger heads.

21. *G. decumbens* Greene, Pitt. 3: 102. 1896, not of most American authors; Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906, as to plant from Cimarron only; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 655. 1915, only as to plant from type locality, Cimarron.

G. erecta A. Nels. acc. to Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906, as to plant from Cerro Summit only.

Herbaceous perennial; stems several or many, slender, loosely corymbosely branched near the middle with slender elongated ascending branchlets, glabrous, 1.5–3.8 dm. (sometimes up to 8 dm.) tall; leaves firmly membranaceous, entire to dentate, main cauline 2–8 cm. long, mostly 0.6–1.5 cm. broad, 3–7 times longer than broad, broadly or narrowly oblong to spatulate, acute to obtuse, the middle and especially the upper subamplexicaul, glabrous; heads radiate, 1.8–2.8 cm. broad; disk campanulate-hemispherical, 0.8–1.1 cm. high, 0.6–1.5 cm. broad; involucre moderately resinous, usually 5-seriate, the free portion reflexed, bracts 3–7 mm. long, linear-lanceolate or lanceolate-subulate to oblong-lanceolate with subterete slender tips, glabrous; rays 12–19, the lamina 7–10 mm. long; achenes oblong, 3–3.5 mm. long, 1–1.2 mm. broad, light brown to stramineous, striated, obliquely truncate to minutely bordered at the apex; awns mostly 2 to the central disk-florets, and 3–4 to the outer disk- and ray-florets, remotely to usually moderately serrulate or setulose-serrulate, 3.5–5 mm. long, $\frac{2}{3}$ to almost equalling length of disk-floret.

Distribution: dry open hillsides and canyon slopes, southwestern to west-central Colorado in region of Gunnison Watershed.

COLORADO: dry canyon sides, Norwood Hill, San Miguel Co., alt. 7000 ft., Aug. 12, 1912, *Walker 463* (G, MU, R); Cerro Summit, region of the Gunnison Watershed, alt. 8000 ft., Aug. 1, 1901, *Baker 702* (CAL, G, MU, NY, PO, R, US); 10 miles east of Montrose, Montrose Co., alt. 1220 m., Aug. 29, 1931, *Moore & Steyermark 3780* (M); 13 mi. north of Ouray, Ouray Co., alt. 1900 m., Aug. 29, 1931, *Moore & Steyermark 3778* (M); Cimarron, Aug. 30, 1896, *Greene* (N TYPE).

21a. var. *subincisa* (Greene) Steyermark, comb. nov.

G. subincisa Greene, Pitt. 4: 154. 1900; Rydb. in Colo. Agr.

Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906; Coult. & Nels. in New Man. Bot. Cent. Rocky Mts. 490. 1909; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 655. 1915; Rydb. Fl. Rocky Mts. 848. 1917, excluding Arizona specimens; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] 25: 535. 1925.

Leaves rather thin, submembranaceous, denticulate to dentate, the uppermost sometimes entire, the lower and basal cauline often becoming coarsely or incised dentate to pinnatifid, elongated, the main cauline 2–6 cm. long, 3–7.5 mm. broad, 6–15 times longer than broad, linear- or lanceolate-oblong to oblanceolate, acute; disk hemispherical to mostly depressed hemispherical; the outer involucral bracts more loosely spreading; rays 17–24, the lamina 8.5–12 mm. long; awns remotely serrulate or occasionally moderately serrulate.

Distribution: gravelly banks, low ground, and along stream courses, southwestern Colorado and adjacent north-central New Mexico.

COLORADO: gravelly banks in town, Durango, July 19, 1898, *Baker, Earle & Tracy* 497 in part (M, NY); Osier, alt. 2920 m., July 13, 1910, *Eggleston* 5946 (US); Durango, July 26, 1898, *Baker, Earle & Tracy* 600 (F, G, M, MU, NY, PO, US).

NEW MEXICO: Chama, Sept. 5, 1899, *Baker* 683 (CAL, F, G, M, NY, PO, R); vicinity of Antonito, July 7, 1911, *Standley* 6506 (US); Chama, July 18, 1898, *Earle* 36 (NY); along the river, vicinity of Chama, Rio Arriba Co., alt. 2380–2850 m., July 8, 1911, *Standley* 6519 (US); Santa Fe, July 29, 1916, *Bro. Bertrand* 80 (US).

This species has been thoroughly confused with *G. arizonica*. Most authors have treated *G. arizonica* and varieties as *G. decumbens*. However, a study of the type plant and subsequent collections discloses the fact that *G. decumbens* is the plant of southwestern and west-central Colorado with revolute or recurved involucral bracts, whereas *G. arizonica* and varieties have bracts with short, erect or appressed tips.

22. *G. laciniata* Rydb. Fl. Rocky Mts. 848 and 1066. 1917; Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] 25: 535. 1925.

G. subincisa Greene acc. to Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] 25: 535. 1925, in part, as to specimens from Arizona.

Herbaceous perennial; stems several, slender, branched above with slender closely ascending branchlets, glabrous, 2.5–4.5 dm. tall; leaves submembranaceous to firmly membranaceous, dull green, scarcely resinous-punctate, the lower and middle cauline pinnatifid, 2–6 cm. long, 0.3–1.5 cm. broad, with coarse spreading segments 2–7 mm. long, 1–2 mm. broad, linear-oblong to oblanceolate, acute, narrowed at base, glabrous; heads radiate, 1.5–2 cm. broad; disk hemispherical, 7–10



Fig. 18. *G. decumbens*. $\times \frac{1}{5}$ Fig. 19. *G. laciniata*. Fig. 20. *G. arizonica*. $\times \frac{1}{5}$
 $\times \frac{1}{5}$.

mm. high, 7–10 mm. broad; involucre bracts 2.5–6 mm. long, lanceolate to lanceolate-oblong, acute to acuminate, closely erect-appressed, only the upper $\frac{1}{3}$ – $\frac{1}{2}$ of the outer bracts free and spreading, with very short tips 1–2 mm. long, glabrous or minutely ciliolate on margins; rays 12–15, the lamina 7–10 mm. long; achenes oblong, 2.5–3.5 mm. long, 1–1.2 mm. broad, dark brown, with 2 teeth or projections on the angles, or truncate; awns 3–5, slender, remotely serrulate, 3–4 mm. long, mostly $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-corolla.

Distribution: dry mesas and canyons of southeastern Utah and south to vicinity of Williams and Seligman, north-central Arizona.

ARIZONA: Seligman, June 22, 1916, *Eastwood 5934* (CAS); Seligman, Aug. 10, 1911, *Wooton* (US); near Williams, Aug. 18, 1915, *Rusby* (NY).

UTAH: mesa east of Monticello, alt. 2100 m., July 25, 1911, *Rydberg & Garrett 9210* (NY); meadow south of Monticello, alt. 2100 m., July 24, 1911, *Rydberg & Garrett 9149* (CAL, NY, R); Montezuma Canyon, east of Monticello, alt. 2000 m., Aug. 13, 1911, *Rydberg & Garrett 9692* (G, MU, isotypes, NY TYPE).

23. *G. arizonica* Gray in Proc. Am. Acad. **17**: 208. 1882; Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, as to synonym and plants of *Rothrock* and *Brandeggee*, not plants of *Palmer* and *Wright*.

G. microcephala Rothr. in Rept. Wheeler Exp. **6**: 141. 1878, not *G. microcephala* DC.

G. setulifera Woot. & Standl. in Contr. U. S. Nat. Herb. **16**: 179. 1913; in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915.

Stems erect, usually several from an herbaceous base, irregularly or subcorymbosely branched above with ascending slender branchlets, 2.5–4.5 dm. tall; leaves membranaceous, scarcely resinous-punctate, finely and remotely setulose-denticulate with short fine teeth from base to apex, 1.5–4.5 cm. long, 0.1–1 cm. broad, 3–6 times longer than broad, the main middle and upper cauline oblong to oblanceolate, acutish, mucronate, about as broad at the base as at the middle, the lower cauline gradually narrowed at base, glabrous except for minutely scabridulous margins; heads radiate, about 2 cm. broad; disk campanulate-hemispherical to deeply campanulate, the sides not distending downwards in fruit, 0.8–1 cm. high, 0.8–1.7 cm. broad; involucre scarcely to moderately resinous, 4–5-seriate, the bracts 4–9 mm. long, broadly lanceolate to oblong-lanceolate with mostly short flattened, acuminate or acute, setulose, deltoid to triangular-lanceolate tips, all erect and appressed, glabrous; rays 15–20, the lamina about 7–8 mm. long; achenes oblong, 3–3.5 mm. long, 1.5–2 mm. broad, horizontally truncate at apex; awns 2 to the floret, entire, 4–5 mm. long, $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: on mesas along escarpments and rivers, east-central Arizona and adjacent southwestern New Mexico.

NEW MEXICO: high summits, Mogollon Mts., Sept., 1881, *Rusby 206* (F, G, M, MU, NY, US, TYPE collection of *G. setulifera*); Bear Mt., 5 mi. from Silver City, Grant Co., July 12, 1928, *Wolf 2606* (ST).

ARIZONA: near summit, Pleasant Valley Road, Sierra Anchas, Oct. 10, 1931, *Harrison, Kearney & Fulton 8334* (B); Pine Creek, near Pine, Aug. 26, 1891, *McDougal* (MU); Black River, alt. 5500 ft., Sept., 1874, *Rothrock 796* (F, G TYPE).

23a. var. stenophylla Steyermark, var. nov.²⁴

G. decumbens Greene acc. to Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] 100: 338. 1906, in large part; acc. to Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 655. 1915, as to plants from Farmington and Dulce; acc. to Rydb. Fl. Rocky Mts. 847. 1917; acc. to Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. 1932.

Stems subpaniculately, subfastigiately or corymbosely much-branched above with rather numerous slender floriferous branchlets usually bearing numerous heads; main cauline leaves mostly entire to serrate or denticulate around apex with fine to coarse teeth, 3–7 cm. long, 0.4–2 cm. broad, mostly 5–8 times longer than broad, narrowly oblanceolate to spatulate-lanceolate, acute to acutish; awns 2–3, 3.5–4.5 mm. long.

Distribution: alluvial ground along river courses, spreading into dry fields, waste places, and dry ground on mesas, southwestern Colorado and adjacent northwestern New Mexico.

COLORADO: near Bayfield, Aug. 12, 1904, *Wooton 2568* (US TYPE); Mancos, July 4, 1895, *Eastwood* (G); Pagosa Springs, Aug. 30, 1899, *Baker 682* (CAL, F, G, M, NY, PO, R, US); dry fields south of town, Durango, July 20, 1898, *Baker, Earle & Tracy 538* (F, G, M, MU, NY, PO, R, US); Tum's Ranch, Rio Mancos, Aug., 1875, *T. S. Brandegee 1134* (CAL); trail between Parrott City and Rio Mancos, Sept., 1875, *T. S. Brandegee 4373* (M).

NEW MEXICO: shale soils, Cuba, Aug. 24, 1931, *Nelson 11718* (M); dry fields, vicinity of Farmington, San Juan Co., alt. 1550–1650 m., July 17, 1911, *Standley 6899* (US); dry fields, Jicarilla Apache Reservation, near Dulce, alt. 2150–2470 m., Aug. 20, 1911, *Standley 8141* (US).

²⁴*G. arizonica* var. *stenophylla* Steyermark, var. nov., caulibus subpaniculate vel subfastigiate et valde ramosis, ramusculis floriferis multis tenuibus elongatis, capitula multa ferentibus; foliis caulinis principalibus plerumque integris vel apud apicem serratis vel remote denticulatis cum dentibus tenuibus vel grossis, 3–7 cm. longis, 0.4–2 cm. latis, plerumque 5–8 plo longioribus quam latis, anguste oblanceolatis, spathulato-lanceolatis vel oblongo-oblanceolatis, acutis vel acutiusculis, plerumque ad basem attenuatis.—Collected near Bayfield, Colorado, Aug. 12, 1904, *E. O. Wooton 2568* (U. S. Nat. Herb. no. 1487285 TYPE).

23b. var. *dentata* Steyermark, var. nov.²⁵

G. arizonica Gray acc. to Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] 19: 655. 1915, as to plant from Bear Mountain.

Stems 3.5–5 dm. tall, stoutish below, mostly branched near the base to below the middle with spreading-ascending branchlets bearing solitary or few heads; main lower, middle, and sometimes the upper, cauline closely and sharply serrate or dentate with rather broad spinulose- or setulose-tipped teeth, those on floriferous branchlets and towards the heads with more slender teeth, the main lower and middle cauline 3–6 cm. long, 0.8–1.3 cm. broad, $1\frac{3}{4}$ –4 times longer than broad, oblong to spatulate-oblong, mostly obtuse or acutish, slightly narrower or about as broad at base as at the middle; awns 3.3–4.5 mm. long, remotely serrulate to setulose-serrulate, acute.

Distribution: on Bear Mountain, near Silver City, Grant Co., southwestern New Mexico.

NEW MEXICO: on Bear Mountain, near Silver City, Grant Co., alt. about 8000 ft., Sept. 19, 1903, *Metcalf* 744 (G, M, MU, N, NY, R, US TYPE).

23c. var. *microphylla* Steyermark, var. nov.²⁶

Stems slender, subpaniculately much-branched from about the middle with elongated ascending floriferous branchlets; leaves subcoriaceous, firm, the middle and upper cauline and those on floriferous branchlets finely and remotely setulose-denticulate or serrulate with short fine teeth, 1–2.5 cm. long, 0.3–0.7 cm. broad, 4–5 times longer than broad, oblong to oblong-lanceolate, acute or acutish, slightly narrower or about as

²⁵ *G. arizonica* var. *dentata* Steyermark, var. nov., caulibus prope basem vel infra medium plerumque ramosis, capitula solitaria vel pauca ferentibus; foliis caulinis inferioribus vel mediis contiguis et salienter serratis vel dentatis cum apicibus latiusculis spinulosis vel setulosis, obtusis vel acutiusculis.—Collected on Bear Mountain, near Silver City, Grant Co., New Mexico, Sept. 19, 1903, *O. B. Metcalf* 744 (U. S. Nat. Herb. no. 495706 TYPE, G, M, MU, N, NY, R, isotypes).

²⁶ *G. arizonica* var. *microphylla* Steyermark, var. nov., caulibus 5–5.5 dm. et plus altis, subpaniculate et valde ramosis; foliis subcoriaceis, 1–2.5 cm. longis, 0.3–0.7 cm. latis, tenuiter et remote setuloso-denticulatis vel serrulatis cum dentibus brevibus minutis; aristis 5–6.5 mm. longis, apice acuminato tenui.—Collected along San Francisco River, 10 miles north of Clifton, Arizona, Sept. 7, 1902, *A. Davidson* 736 (96) (Gray Herb TYPE, CAL, PA, R, isotypes).

broad at base as at middle; awns entire, gradually acuminate to a slender apex, 5–6.5 mm. long.

Distribution: along San Francisco River, north of Clifton, Greenlee Co., southeastern Arizona.

ARIZONA: San Francisco River, 10 miles north of Clifton, Sept. 7, 1902, *Davidson 736 (96)* (CAL, G TYPE, PA, R).

24. *G. scabra* Greene in Bull. Torr. Bot. Club **25**: 120. *pl.* 332. 1898; Woot. & Standl. Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915.

Stems 1–4 from an herbaceous base, usually slender, loosely corymbosely branched, mostly suffused with reddish-purple, villous or villosulous-puberulent, less so below, 2–7 dm. tall; leaves rather thin, submembranaceous, dull green, scarcely punctate, usually moderately denticulate or setulose-denticulate, the lower more coarsely dentate, 2–8.5 cm. long, 0.5–2.5 cm. broad, the majority ovoid-oblong to lanceolate, the lower oblong-spatulate to broadly oblanceolate, obtuse to acute, all but the lowest usually subamplexicaul, mostly minutely puberulent; heads radiate, 2.5–4 cm. broad; disk 0.7–1.1 cm. high, 1.0–1.8 cm. broad; involucre scarcely resinous; bracts 6–11 mm. long, loosely erect, ascending or spreading, the outer elongated, usually about equalling the height of the disk, linear- or lanceolate, with mostly filiform-subulate tips, scaberulent on surfaces and margins, the inner oblong-lanceolate or oblanceolate, glabrate; rays 17–30, the lamina 12–15 mm. long; achenes oblong, 2.5–3 mm. long, 1.5–2 mm. broad, light brown, smooth to slightly striate, mostly obliquely truncate at apex; awns 2–4, nearly capillary, moderately to numerous setulose, 3–5 mm. long, mostly $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: dry rocky slopes or mesas in mountains of the eastern slope of the southern Rocky Mountain axis of southeast-central New Mexico and the Davis Mountains of northwestern Texas.

TEXAS: dry rocky ground on ridge above Little Ajuga Canyon, Davis Mts., Jeff Davis Co., alt. 1500 m., June 13, 1931, *Moore & Steyermark 3043*, and June 17, 1931, *Moore & Steyermark 3151* (M).

NEW MEXICO: White Mts., Lincoln Co., alt. 6300 ft., July 28, 1897, *Wooton 224* (CAL, G, M, MU, NY, PO, R, TYPE collection); Mescalero Indian Reservation, White Mt. Region, Lincoln Co., alt. 6500 ft., June 23, 1895, *Wooton* (US); Cold Spring Cañon, Sacramento Mts., Otero Co., Aug. 17, 1899, *Wooton* (US); Tularosa

Creek, 3 mi. south of Mescalero Agency, Otero Co., alt. 6930 ft., July 19, 1928, *Wolf 2772* (CAS); White Mts., Lincoln Co., alt. 6300 ft., Aug. 21, 1897, *Wooton 372* (CAL, G, M, MU, NY, PO, R, US, COTYPES).

24a. var. *neomexicana* (Woot. & Standl.) Steyermark, comb. nov.

G. neomexicana Woot. & Standl. in Contr. U. S. Nat. Herb. **16**: 198. 1913; in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915.

G. arguta f. *glabra* Gray in Smithson. Inst. Contr. [Pl. Wright. pt. 2] **5**⁶: 81. 1853.

G. arizonica Gray acc. to Gray, Syn. Fl. N. Am. **1**²: 118. 1884, as to plant of *Wright* only.

G. squarrosa var. *grandiflora* (Hook.) Gray acc. to Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, in small part, as to plant from Hort. Cantab. in Gray Herb. and in part of description as to "leaves . . . with . . . spinulose teeth."

G. arguta Schrad. acc. to Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, as synonym.

Stems smooth, glabrous; leaves glabrous except for the scabridulous margins.

Distribution: dry rocky slopes of canyons and ledges, the higher portions of the mountains of southwestern New Mexico and south in the Davis Mountains of northwestern Texas.

TEXAS: rocky ledges, Sawtooth Mountain, Davis Mts., Jeff Davis Co., Oct. 3, 1926, *E. J. Palmer 31877* (M, UT); Fern Canyon, 14 mi. northwest of Alpine, southern Jeff Davis Co., Sept. 18, 1927, *Cory 26*, and Sept. 28, 1927, *Cory 27* (B, US).

NEW MEXICO: Kingston, Sierra Co., in and around the south end of the Black Range, alt. 6600 ft., Sept. 9, 1904, *Metcalfe 1302* (M); mountains north of Santa Rita, Aug. 23, 1900, *Wooton* (US TYPE); Silver City, 1911, *Beard* (M); mountains southeast of Patterson, Aug. 16, 1900, *Wooton* (US COTYPE); on the G.O.S. Ranch in canyons within 10 miles of the ranch house, Grant Co., Aug. 27–Sept. 12, 1911, *Holzinger* (US); sandy clay loam, woodland, Tierra Blanca Canyon, Gila Forest, alt. 6800 ft., Aug. 16, 1915, *Chapline 267* (NY, US).

Wooton and Standley's *G. neomexicana* differs in no essential respects from *G. scabra* except in lack of pubescence, on which character alone specific rank cannot be accorded. Some specimens of *G. scabra* show a tendency towards glabry of the leaves and stems. In New Mexico *G. scabra* is concentrated around the southeast-central portion in the Sacramento and

White Mountain area, whereas the var. *neomexicana* occurs in the mountains of the southwestern part of the state.

The capillary-like pappus awns, and long-filiform or subulate erect or ascending scarcely resinous involucral bracts are characters possessed by *G. scabra* and var. *neomexicana* which point to an ancestry from the more ancient Texan-Mexican alliance, especially (in the case of *G. scabra* with its pubescent stems and leaves) as having originated from some stock simulating *G. inuloides*. The replacement westward by the glabrous *G. scabra* var. *neomexicana* may be considered a derived condition induced by ecological isolation.

25. *G. texana* Scheele in Linnaea **21**: 601. 1848; Gray in Smithson. Inst. Contr. [Pl. Wright. pt. 1] **3**⁵: 98. 1852, as synonym; Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, as synonym; Rydb. in Colo. Agr. Exp. Sta. Bull. [Fl. Colo.] **100**: 338. 1906, as to name only; Coult. & Nels. New Man. Bot. Cent. Rocky Mts. 490. 1909, as to name only; Daniels in U. Mo. Stud. [Fl. Boulder, Colo.] **2**: 226. 1911, as to name only; Woot. & Standl. in Contr. U. S. Nat. Herb. [Fl. N. Mex.] **19**: 655. 1915, as to name and type locality only; Rydb. Fl. Rocky Mts. 848. 1917, as to name only.

G. lanceolata Nutt. acc. to Torr. & Gray, Fl. N. Am. **2**: 248. 1842; Walp. Rep. Bot. Syst. **2**: 959. 1843.

G. squarrosa var. *grandiflora* Gray in Smithson. Inst. Contr. [Pl. Wright. pt. 1] **3**⁵: 98. 1852, excluding *G. grandiflora* Hook.; Walp. Ann. **5**: 191. 1858; Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888, in part, as to description pertaining to "leaves . . . with spinulose teeth," as to plants of *Lindheimer* and *Reverchon*, and excluding *G. grandiflora* Hook.; Coult. in Contr. U. S. Nat. Herb. [Bot. W. Tex.] **2**: 184. 1892, in part, as to description pertaining to "leaves . . . with . . . spinulose teeth."

G. grandiflora of many authors, not *G. grandiflora* Hook. acc. to Small, Fl. Southeast. U. S. 1180. 1903, and ed. 2. 1180. 1913; Blake in Tidestrom in Contr. U. S. Nat. Herb. [Fl. Utah & Nev.] **25**: 535. 1925, as to name and range in Texas.

Herbaceous perennial; stems from a lignified base, sparsely

corymbosely branched in the inflorescence above the middle, usually stramineous or light brown, shining, glabrous, 4.5–9.5 dm. tall; leaves firm, subcoriaceous, light green, scarcely punctate, the basal and lower cauline especially sharply incised-serrate to pinnatifid with teeth or segments deltoid to oblong-lanceolate, 4–15 mm. long, 1–5 mm. broad, the middle and upper cauline coarsely to spinulosely serrate with deltoid to lanceolate spinulose-tipped teeth 1–4 mm. long, acute, leaves lanceolate-oblong to lanceolate-linear, the upper ovate, 1–6.5 cm. long, 0.3–2.5 cm. broad, glabrous except for the margins; heads few, radiate, 2.5–4 cm. broad; disk 1–1.5 cm. high, 1.2–2.4 cm. thick, campanulate-hemispherical; involucre sparingly to moderately resinous, 6–8-seriate, the bracts 4–13 mm. long, lanceolate-subulate to lanceolate-oblong, the innermost erect, appressed and acuminate at apex, the others with upwardly spreading to ascending subulate tips, free about half the entire length, the outer bracts shorter than (frequently only half) the height of the disk, glabrous; rays 21–36, the lamina 12–15 mm. long; achenes oblong to obovate, 3–5 mm. long, 2–2.5 mm. broad, brownish, smooth or striated, the apex inconspicuously bordered or with 1–2 small projections at the angles; awns 2, linear-subulate, stoutish, mostly stouter than in *G. lanceolata* and form, subentire or entire, 4–7 mm. long, nearly equalling the disk-floret.



Fig. 21. *G. texana*. $\times \frac{1}{5}$.

Distribution: on limestone glades and prairies from the Arbuckle Mountains of south-central Oklahoma south in the Texas Hills section and Edwards Plateau of south-central Texas.

OKLAHOMA: in the Indian Territory, chiefly on the False Washita, between Fort Cobb and Fort Arbuckle, 1868, *Ed. Palmer* 452 (NY); Arbuckle Mts., near Davis, Aug. 18, 1917, *Emig* 811 (M); limestone hills, Arbuckle Mountains, near Turner Falls State Park, Garvin Co., Aug., 1933, *E. J. Palmer* 42014 (M).

TEXAS: Comanche Spring, New Braunfels, etc., July, 1849, *Lindheimer* 920 (CAL, F, G, M, NY, PA, US, UT); 1846, *Lindheimer* (G, US); sparsely in dry prairies of the higher mountain valleys, Comanche Spring, July, 1847, *Lindheimer* 83 (G); western Texas, 1852, *Wright* (G, NY, US); Holland, Sept. 5, 1913, *Mackensen* 236 (M); Fort Worth, Sept. 9, 1877, *Ward* (M, US); dry black calcareous soil, Lisbon, Dallas Co., Sept. 10, 1913, *Pennell* 5408 (NY); Spanish Pass, Kendall Co., July 5, 1911, *Mr. & Mrs. J. Clemens* 949 (M, PO); dry hillsides, Blanco, Blanco Co., Sept. 24, 1917, *E. J. Palmer* 12855 (G, M); prairie, Tarrant Co., 1926 or 1927, *Killian* (UT); Cleburne, July 22, 1929, *Whitehouse* 6646 (B, UT); rocky hills, Polytechnic, June 30, 1911, *Ruth* 64 in part (G, M, NY, PA, US); dry calcareous open ground, Burnet, Burnet Co., June 21, 1916, *E. J. Palmer* 10249 (M); Austin, Aug. 1921, *Schulz* 688 (PO, US); Half Moon Mt., Gillespie Co., *Jermy* 805 (M, US).

This species has been previously referred to in part as *G. grandiflora* or *G. squarrosa* var. *grandiflora*. Gray²⁷ erroneously combined under *G. squarrosa* var. *grandiflora* three very unlike elements; the first, consisting of plants of *Lindheimer* and *Reverchon* with spinulose-toothed leaves, really pertained to *G. texana*, the second, comprising an obtuse-toothed plant of *Wright*, referred to the new entity as treated in the present monograph, namely, *G. Havardii*, while the third, including an obtuse-toothed plant, collected by *Berlandier*, can be identified with *G. squarrosa* var. *nuda*. It is difficult to understand how Gray could have confused these specimens, since *G. texana* is quite unlike *G. Havardii*, and the latter, a radiate species, is very distinct from the discoid *G. squarrosa* var. *nuda* with which Gray confounded it.

26. *G. lanceolata* Nutt. in Jour. Acad. Phila. **7**: 73. 1834; Torr. & Gray, Fl. N. Am. **2**: 248. 1842, including var. β and excluding var. γ ; Walp. Rep. Bot. Syst. **2**: 959. 1843, including var. β and excluding var. γ ; Gray, Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888; Britt. & Brown, Ill. Fl. N. States **3**: 321. 1898, and ed. 2. **3**: 371. 1913; Rob. & Fern. in Gray's New Man. Bot. ed. 7. 786. 1908; Small, Fl. Southeast, U. S. 1180. 1903, and ed. 2. 1180. 1913; Rydb. Fl. Pr. & Pl. Cent. N. Am. 784. 1932.

²⁷ Gray, A., Syn. Fl. N. Am. **1**²: 118. 1884, and ed. 2. 118. 1888.

Donia lanceolata Hook. acc. to Eaton & Wright, N. Am. Bot. ed. 8. 227. 1840, not Hooker; acc. to Eaton, Man. Bot. N. Am. ed. 7. 281. 1836, not Hooker.

Herbaceous biennial; stems one to several from a semi-ligneous base, corymbosely much-branched above the middle, ochroleucous or stramineous below, the upper part suffused with reddish-purple, glabrous or infrequently sparsely pilose near the base, 0.3–1.5 m. tall; leaves firmly membranaceous, light green, scarcely punctate, entire or finely serrulate to sharply serrate, acute to acuminate, the lower and middle cauline 3.5–11 cm. long, 0.35–2 cm. broad, linear to lanceolate-oblong, the upper cauline and those on floriferous branchlets shorter, 4–12 times longer than broad, mostly glabrous, the margins scabrid, lower cauline and basal frequently short-pilose on both surfaces; receptacle conspicuously foveolate; heads radiate, 3–3.5 cm. broad; disk campanulate-hemispherical in anthesis, 0.8–1.3 cm. high, 1.2–2.3 cm. broad; involucre sparingly and inconspicuously resinous, the bracts 8–16 mm. long, linear or lanceolate, acuminate at apex, with loosely spreading to ascending filiform subulate tips, these free for $\frac{1}{2}$ – $\frac{7}{8}$ the length of the bract, the inner bracts erect, appressed, and usually exceeding the height of the disk, the outer about equalling the height of the disk, glabrous; rays 14–29, the lamina 10–16 mm. long; achenes oblong to linear-oblong, 4–6 mm. long, 2–2.5 mm. broad, stramineous to grayish or grayish-brown, smooth, lustrous, the apex inconspicuously crowned or with 1–2 small projections at the angles; awns 2, linear, slender, sometimes slightly dilated at apex, entire, 4–7 mm. long, about as long as the disk-floret.

Distribution: limestone glades and rocky prairies from the Ozark region of Missouri and Arkansas, and southeastern Kansas south to northeastern Texas, locally eastward in Tennessee and central and northern Alabama.

LOUISIANA: *Leavenworth* (G, NY).

TENNESSEE: cedar glades near Lavergne, Rutherford Co., Aug. 18, 1897, *Eggert* (CAL, F, M, NY, US); cedar barrens at Lavergne, June, 1879, *Gattinger* (M, NY, PA, US); dry fields, Nashville, July and Aug., 1897, *Williamson* (PA, NY); Nashville, *Gattinger* (CAL, M, US).

ALABAMA: Jonesboro, *E. A. Smith* (F, US); Colbert Co., *E. Smith* (MA).

MISSOURI: along R. R. tracks just north of Washington University grounds, op-

posite men's fraternities, St. Louis Co., Oct. 13, 1930, *Steyermark* 1506 (M); in dense colonies on limestone glade, above St. Peter sandstone bluffs, 8 miles northwest of Pevely, Jefferson Co., Sept. 11, 1932, *Steyermark* 7164 (M); dry open ground, limestone hills, near Carthage, Jasper Co., Oct. 6, 1925, *E. J. Palmer* 29049 (G, M); common in woods, Cartersville, Aug. 17, 1902, *E. J. Palmer* 181 (M); thickets and open limestone ledges, near Eve, Vernon Co., Aug. 7, 1933, *E. J. Palmer* 42157 (M); shale outcrops, hillsides, Noel, McDonald Co., Sept. 7, 1913, *E. J. Palmer* 4161 (M, R); Little Osage River near the Mo. state line, Aug. 1869, *Broadhead* (M); Cedar Gap, Sept. 25, 1903, *Standley* (US); Bagnell to Linn Creek, Camden Co., Sept. 17, 1897, *Trelease* 547 (M); near Ava, Sept. 2, 1929, *Rickett* (MO).

ARKANSAS: Maumee, Searcy Co., Aug. 8, 1913, *Emig* 45 (M); White River bottom, south of Batesville Ferry, July 29, 1887, *Coville* 197 (US); locality lacking, *Pitcher* (PA TYPE, NY); dry situations, prefers limestone, Fayetteville, *Harvey* 48 (M, MU, PA, US); dry rocky bluffs, Cotter, Baxter Co., Aug. 31, 1915, *E. J. Palmer* 8403 (M, NY); rocky hillsides, Jasper, Newton Co., Oct. 28, 1914, *E. J. Palmer* 6936 (M); Hot Springs, Aug., and Aug. 5-6, 1879, *Letterman* (F, M); Little Rock, Aug., 1879, *Letterman* (M).

KANSAS: prairie, Allen Co., 1896, *A. S. Hitchcock* 714 (G, M, NY, US); Crawford Co., Aug. 12, 1897, *Clothier & Whitford* 5459 (PO); open ground, limestone outcrops, along prairie creek, near Valeda, Labette Co., July 21, 1933, *E. J. Palmer* 41779 (M).

OKLAHOMA: Cherokee Nation, Aug. 19, 1895, *Blankinship* (G, M, US); Atoka, 1874, *Butler* (M); on rocky hillside, near Burbank, Osage Co., Aug. 7, 1913, *Stevens* 1950 (G, M, MU, NY, US); dry grassy roadside, Miami, Ottawa Co., Aug. 27, 1913, *Stevens* 2446 (G, MU); Sans Bois Mts., Aug. 21, 1891, *Sheldon* 308 (US); uncommon, Sapulpa, July 27, 1894, *Bush* 220 (G, M, NY, US).

TEXAS: on limestone rocky ground, Dallas Co., Aug. 31, 1926, *Ruth* 1432 (US); S. Felipe de Austin, "Hooker misit," Jan., 1835, *Drummond* 137 (G); prairie, Ft. Worth, 1926, *Killian* 6599 (B, UT).

26a. f. *latifolia* Steyermark, f. nov.²⁸

Leaves broadly oblong, oblong-lanceolate, or especially the upper ovate-lanceolate, acute, sharply denticulate or serrulate, at least the upper and middle cauline subamplexicaul, 2½-3 times longer than broad, the larger 5.5-7 cm. long, 2-2.8 cm. broad.

Distribution: limestone hills, southwestern Missouri and eastern Oklahoma.

MISSOURI: Marble Cave, Stone Co., Sept. 11, 1898, *Trelease* (M TYPE).

OKLAHOMA: dry limestone prairies, Hugo, Choctaw Co., Oct. 25, 1915, *E. J. Palmer* 9013 (M, NY).

²⁸ *G. lanceolata* f. *latifolia* Steyermark, f. nov., foliis late oblongis, oblongo-lanceolatis, superioribus ovato-lanceolatis, majoribus 5.5-7 cm. longis, 2-2.8 cm. latis.—Collected at Marble Cave, Stone Co., Missouri, Sept. 11, 1898, *W. Trelease* (Mo. Bot. Gard. Herb. No. 129998 TYPE).

This species is quite variable as to leaf shape, size, and margin, but the variations are not concomitant. On the limestone barrens of Tennessee and in portions of southwestern Missouri, southeastern Kansas, and Oklahoma, are plants with narrower leaves and subentire or finely setulose margins, but too many inconstancies and intergradations are encountered for these variations to be significant. In the vicinity of Dallas, Texas, a region of range overlap of *G. texana* and *G. lanceolata* (near the northeastern limit of *G. texana* and near the southwestern limit of *G. lanceolata*) collections have been taken which are intermediate between, and may be hybrids of *G. texana* and *G. lanceolata*.

27. *G. littoralis* Steyermark, sp. nov.²⁹

Stems sparsely branched and elongated above in the inflorescence, brownish to stramineous, glabrous; leaves coriaceous to subcoriaceous, dark olive-green, moderately or conspicuously punctate and resinous, closely and upwardly appressed-serrulate, the middle and upper cauline 3–5.5 cm. long, 0.8–1.5 cm. broad, lanceolate- to elliptic-oblong or elliptic-lanceolate, rather abruptly narrowed to the sessile base, with a slender acuminate tip, glabrous; heads radiate, 3–3.5 cm. broad; disk campanulate-hemispherical in anthesis, 0.8–1.2 cm. high, 1.4–2 cm. broad; involucre moderately to abundantly resinous, the bracts 8–13 mm. long, linear or lanceolate to lanceolate-oblong with loosely spreading or ascending filiform-subulate tips free for $\frac{1}{2}$ – $\frac{7}{8}$ their length, the outer ones strongly arcuate-involute above, about equalling the height of the disk, glabrous; rays 25–31, the lamina 11–13 mm. long; achenes oblong, 3.5–4 mm. long, about 2 mm. broad, stramineous, smooth, shining, the apex bordered by an irregular slightly raised margin or with 1–2 small projections at the angles; awns 2, rather

²⁹ *G. littoralis* Steyermark, sp. nov., foliis subcoriaceis, moderatim vel valde resinoso-punctatis, tenuiter serrulatis cum dentibus valde appressis et incurvis, caulinis mediis et superioribus 3–5.5 cm. longis, 0.8–1.5 cm. latis, lanceolatis vel elliptico-oblongis vel elliptico-lanceolatis, ad basem angustiusculis; involucre moderatim vel valde resinoso, bracteis lineari- vel lanceolato-subulatis, exterioribus valde arcuato-involutis.—Collected at Evergreen, Galveston Bay, Texas, Sept. 20, 1884, Joor (Mo. Bot. Gard. Herb. no. 130019 TYPE).

slender, mostly dilated towards apex, the margins minutely marked with several remote projections, 4.2–6 mm. long, about equalling the disk-floret.

Distribution: Galveston Bay region of southeastern Texas.

TEXAS: beach, Evergreen, Galveston Bay, Sept. 20, 1884, *Joor* (M TYPE); Kemah, alt. 20 ft., Aug. 19, 1917, *Fisher 5156* (CAS, US); Kemah, alt. 20 ft., Sept. 6, 1926, *Fisher 265* (B, US); La Porte, Aug. 9, 1913, *Fisher 629* (US); Houston, Aug. 10, 1921, *Fisher 119* (US).

This endemic of the Galveston Bay region is intermediate between *G. lanceolata* and *G. texana*. It possesses a larger amount of resin both on the leaves and involucre than either of the latter species; the leaf margins have teeth which are closely appressed and incurved, whereas in *G. texana* and *G. lanceolata* the teeth are directed outward and are more salient; the pappus awns in *G. littoralis* are mostly marked with several projections, whereas in the other two species they are entire or subentire.

This species may have been derived from a Mexican type similar to *G. Greenei* to which it is related. *Grindelia littoralis* has subpaleaceous pappus awns, whereas those in *G. Greenei* are capillary-like.

28. *G. Greenei* Steyermark, sp. nov.³⁰

Stems amber or fulvous-brown, glabrous, up to 1.2 m. tall; leaves subcoriaceous, dark olive-green, moderately resinous-punctate, evenly and closely serrulate with aristate or spinulose-tipped teeth from base to apex, the upper cauline 1.9–2.9 cm. long, 1–1.5 cm. broad, $1\frac{1}{2}$ – $2\frac{1}{3}$ times longer than broad, ovate to oblong- or elliptic-ovate, acuminate-cuspidate, slightly narrowed at the base, glabrous; inflorescence sparingly sub-

³⁰ *G. Greenei* Steyermark, sp. nov., caulibus glabris; foliis subcoriaceis, moderatim resinoso-punctatis, regulariter et contigue serrulatis cum dentibus aristatis vel spinulosis, caulinis superioribus 1.9–2.9 cm. longis, 1–1.5 cm. latis, $1\frac{1}{2}$ – $2\frac{1}{3}$ plo longioribus quam latis, ovatis vel oblongo- vel elliptico-ovatis, acuminato-cuspidatis, ad basem paullum attenuatis, glabris; capitulis 2.5–2.7 cm. latis; disco campanulato-hemispherico, 0.8–1 cm. alto, 1.3–1.7 cm. lato; involucre moderatim resinoso, bracteis liberis, patentibus, 4–7.5 mm. longis, lineari- vel lanceolato-subulatis, glabris; achaeniis laevibus.—Collected in vicinity of Monterrey, State of Nuevo Leon, Mexico, 1924, *C. R. Orcutt 1204* (U. S. Nat. Herb. no. 1207776 TYPE).

corymbosely branched; heads radiate, 2.5–2.7 cm. broad; disk campanulate-hemispherical, 0.8–1 cm. high, 1.3–1.7 cm. broad; involucre moderately resinous, 0.8–0.9 cm. high, the bracts 4–7.5 mm. long, the upper $\frac{1}{3}$ – $\frac{1}{2}$ free and spreading, the outer and middle linear to lanceolate with subulate flattened subcoriaceous tips 2–3 mm. long, glabrous; rays 15–20; achenes oblong, 2.3–3 mm. long, 1–1.5 mm. broad, fulvous-brown, shining, smooth, truncate at apex; awns 2–3 to the floret, capillary-



Fig. 22. *G. lanceolata*. $\times \frac{1}{5}$ Fig. 23. *G. Greenei*. $\times \frac{2}{5}$ Fig. 24. *G. oolepis*. $\times \frac{1}{5}$.

linear, entire, acute, 4–5 mm. long, about $\frac{7}{8}$ length of disk-floret.

Distribution: vicinity of Monterey, State of Nuevo Leon, northeastern Mexico.

MEXICO: NUEVO LEON—Monterey, 1924, *Orcutt 1204* (US TYPE); Monterey, 1924, *Orcutt 1249* (US).

It is a pleasure to name this new species in honor of Dr. E. L. Greene, who perhaps had a keener insight and more understanding of the genus than any other botanist having worked with *Grindelia*.

29. *G. oolepis* Blake in Proc. Biol. Soc. Wash. 41: 139. 1928.

Stems several from a slightly decumbent to ascending base, slender, mostly simple and elongated, some of the older ones becoming ligneous and producing simple herbaceous shoots from the base or from the cauline nodes, obscurely puberulous with few short hairs about the apex of the penduncles, otherwise glabrous, dull green, 1.7–5.5 dm. tall; leaves firmly membranaceous, not resinous-punctate, main cauline entire or sparingly minutely toothed to remotely denticulate, the basal and lower leaves pinnatifid or incised-dentate, main cauline linear, lanceolate-oblong or lanceolate, mostly acute, sessile, the upper with a slightly broader and more clasping base than the lower, leaves 1–5.5 cm. long, 2–7 mm. broad, glabrous to obscurely puberulous; inflorescence a solitary discoid head terminating a simple slender elongated stem; disk hemispherical, 6–9 mm. high, 8–14 mm. broad; receptacle with no obvious foveolation; involucre with only the innermost bracts of young heads slightly resinous, bracts 4–5-seriate, 3–5.5 mm. long, 1–2 mm. broad, all erect and appressed, the outer ovate-lanceolate to lanceolate-oblong with loose or spreading acute flattened tips, glabrous; achenes dark or yellow-brown, dull, smooth to obscurely rugulose, oblong, about 3 mm. long, 1.5–2 mm. broad, truncate at the apex; awns 1–2 to the floret, when 2 unequal, acute, very slender, entire, 4–4.5 mm. long, $\frac{3}{4}$ – $\frac{7}{8}$ the length of the corolla.

Distribution: gumbo soil near coast, in region about Brownsville, southwestern Texas.

TEXAS: black gumbo soil, Brownsville, *Runyon* 295 (PO, US); northeast of Brownsville, Oct. 24, 1927, *Rose & Russell* 24208 (US); in crawfish lands, gumbo soil, El Jardin to Point Isabel Road, Cameron Co., alt. 10 m., Aug. 5, 1923, *Runyon* 506 (US TYPE).

30. *G. Hallii* Steyermark in Ann. Mo. Bot. Gard. 21: 229. 1934.

G. camporum Greene acc. to Hall in U. Cal. Publ. Bot. [Compos. S. Cal.] 3: 39. 1907, only as to plants of *Chandler* 5460 and *Brandeggee*, Cuyamaca Mts., July 8 and Oct. 15, 1894.

Herbaceous perennial, mostly with persistent basal rosettes of leaves; stems usually several, slender, corymbosely branched above with divergently ascending floriferous branchlets bear-

ing numerous heads, glabrous, 2.5–6 dm. tall; leaves subcoriaceous, abundantly and conspicuously resinous-punctate, rather lustrous, serrulate or sharply serrate to entire, 1–7.5 cm. long, 0.2–1.2 cm. broad, 3–8 times longer than broad, oblong-ob lanceolate to lanceolate, acute to obtuse, narrowed toward the base to (the upper) subamplexicaul, glabrous except for the minutely scabridulous surface; heads radiate, 1.5–2 cm. broad; disk campanulate-hemispherical, 0.7–1 cm. high, 0.8–1.7 cm. broad; involucre abundantly and conspicuously resinous, about 5-seriate, outer and middle bracts with short acute to acuminate flattened spreading deflexed or slightly reflexed tips, inner and often the middle with tips mostly erect, 2–8 mm. long, linear-lanceolate to lanceolate, glabrous; rays 10–20, the lamina 8–9 mm. long; stigmas narrowly oblong-lanceolate; achenes oblong, light brown or mostly stramineous, 4.5–5 mm. long, about 2 mm. broad, smooth to furrowed, conspicuously unidentate or knobbed at the apex or obliquely truncate; awns 2 to the floret, slender, entire to remotely serrulate, 2.5–4 mm. long, $\frac{1}{2}$ – $\frac{3}{4}$ length of disk-floret.

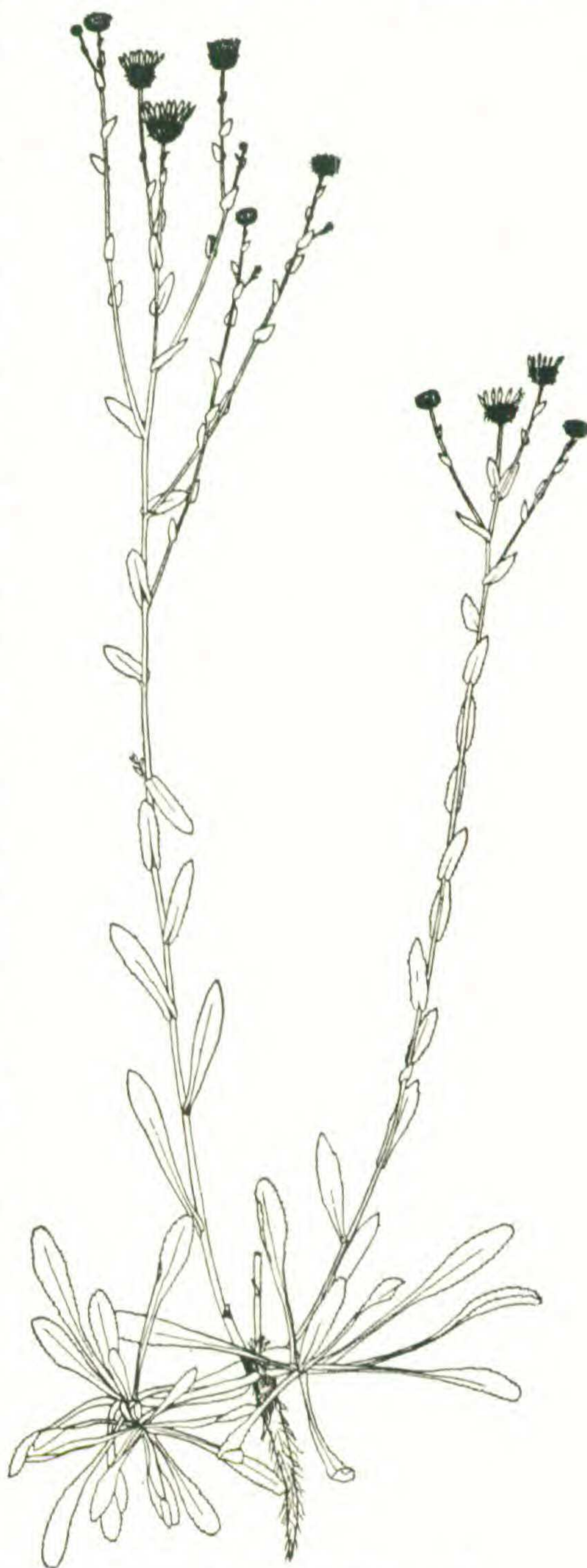


Fig. 25. *G. Hallii*. $\times \frac{1}{5}$.

Distribution: dry rocky slopes, ridges, and mesas in the region of Cuyamaca Lake and San Diego, southern San Diego Co., California.

CALIFORNIA: abundant about dam, Cuyamaca Lake, alt. 4600 ft., June 24, 1924, *Peirson 4825* (M, P); in woods at auto camp grounds, Cuyamaca Lake, San Diego Co., alt. 4700 ft., Sept. 5, 1932, *Peirson 10472* (E, P, PO); Julian-Cuyamaca, San Diego Co., Sept. 13, 1929, *Hoffmann* (SB); open meadows and dry slopes about Cuyamaca Lake, June 30, 1903, *Abrams 3957* (F, G, M, NY TYPE, PO); Cuyamaca, San Diego Co., July 8, 1894, *T. S. Brandegee* (CAL); Stonewall, Oct. 15, 1894, *T. S. Brandegee* (CAL); Julian, Nov. 11, 1929, *Woodcock 63* (CAL); near Julian, San Diego Co., Aug. 11, 1886, *Orcutt* (M, US); Julian, Cleveland National Forest, July 29–30, 1915, *A. S. Hitchcock* (US); Larkens, Aug. 18, 1875, *Ed. Palmer 128* (F, G, M, NY); Julian, San Diego Co., alt. 4200 ft., July 12, 1904, *Chandler 5460* (CAL, NY).

The involucre bracts in this species are mostly erect and appressed or slightly spreading at the tips, but in late maturity in some cases may become more recurved and spreading. Collections have been obtained from the region around San Diego, California, which are somewhat intermediate between, and may possibly represent hybrids of, *G. Hallii* and *G. rubricaulis* var. *elata*. *Grindelia Hallii* possesses leafy rosettes which remain attached at the base of the stem.

This species is named in honor of the late Dr. H. M. Hall of the Carnegie Institution. Dr. Hall's interest in this genus, to the extent of photographing types in foreign herbaria, obtaining fragments of the types, and in furnishing critical accompanying notes with the photographs, has been of inestimable aid to the writer.

31. *G. procera* Greene, Man. Bot. San Franc. Bay Reg. 172. 1894; Fl. Franc. pt. 4. 362. 1897; Jepson, Fl. W. Mid. Cal. 555. 1901; J. T. Howell in Madroño **2**²: 21. 1931.

Herbaceous perennial; stems usually solitary, stout, paniculately to fastigiately much-branched with numerous elongated strongly ascending floriferous branchlets bearing many heads, white or stramineous, mostly scaberulent below, 1.2–3 m. tall; leaves subcoriaceous to submembranaceous, dark olive-green, abundantly resinous-punctate, dentate with rather short acute teeth, to serrulate, 2–8 cm. long, 0.4–3 cm. (sometimes up to 5) broad, mostly 3–7 times longer than broad, oblong-lanceolate to lanceolate and acute, slightly subamplexicaul to amplexicaul, glabrous (except the slightly scabridulous margins); heads radiate, mostly 2–3 cm. broad; disk depressed-hemi-

spherical, rather umbonate at the base, 0.8–1 cm. high, 1.1–1.8 cm. broad; involucre slightly to moderately resinous, 4–5-seriate, the outer bracts with the upper third to fourth free and ascending to slightly deflexed, 3–8 mm. long, linear-lanceolate to lanceolate with acute to acuminate submembranaceous slender tips; receptacle conspicuously foveolate; rays mostly 32–44, bright yellow or lemon-yellow, the lamina 8–10 mm. long; stigmas linear-lanceolate; achenes narrowly or linear-oblong, 2–4 mm. long, 1.3–1.5 mm. broad, usually dull to fuscous-brown or occasionally stramineous, smooth to slightly striated or sometimes roughened, 2–3-knobbed or toothed at apex, or the crown or teeth not well developed; awns mostly 2–3, but often 5–6, slender, entire to remotely marked with short projections, 2.3–4 mm. long, $\frac{1}{2}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: plains and alluvial ground along the San Joaquin River from Sacramento to Fresno Co., and about lakes, springy ground and roadsides south in the valley to Kern Co., and to Rock Creek, San Gabriel Mountains, Los Angeles Co., southern California.

CALIFORNIA: Borden Highway, 1 mile west of Holt, San Joaquin Co., Sept. 28, 1930, *J. T. Howell 5511* (CAS, P); Lower Kaweah River Valley, near Visalia, Tulare Co., Aug. 21, 1895, *Dudley 1343* (ST); Huron to Lemoore, Kings Co., Sept. 24, 1920, *Abrams 7705* (ST); near Galt, Sacramento Co., Sept. 14, 1917, *Abrams 6751* (ST); river bottom, 1 mi. west of San Joaquin River bridge near Lathrop, San Joaquin Co., Oct. 11, 1930, *J. T. Howell 5550* (CAS, G, M); San Joaquin bridge, Sept. 9, 1901, *T. S. Brandegee* (CAL); Visalia, July 31, 1892, *T. S. Brandegee* (CAL); in dry flats along river, San Joaquin River at Valley Boulevard, Fresno Co., Oct. 22, 1925, *Peirson 6467* (P, PO); near highway, $1\frac{1}{2}$ miles southeast of Modesto, Stanislaus Co., July 22, 1929, *J. T. Howell 4351* (CAS); Rock Creek, San Gabriel Mts., Los Angeles Co., alt. 4000 ft., Sept. 5, 1928, *Peirson 8190* (M, P); common in low ground near Hanford, June 20, 1901, *Kearney 58* (M, US); roadside near Mojave, Kern Co., Oct. 1, 1931, *Hoffmann* (SB); Porterville, Sept. 20, 1921, *Kelly* (CAS); Bakersfield, Sept. 28, 1910, *McGregor 6* (NY, ST); Buena Vista Lake, Kern Co., June 23, 1926, *Hart* (CAS).

From 1901, when Jepson included this species in his 'Flora of Western Middle California,' *G. procera* remained unrecognized as a valid species until 1931, when Mr. J. T. Howell³¹ stated his positive opinion as to its validity. The present author has studied living and herbarium material of *G. procera* Greene, and finds himself in full agreement with Mr. Howell.

³¹ Howell, J. T. in *Madroño* 2²: 21. 1931.

It is a very distinct species, and the only possible reason that it has been ignored for 30 years is probably due to the state of confusion and misunderstanding existing in most of the species of *Grindelia*. That it is readily distinguished from *G. camporum*, with which most authors have confused it, may be discerned from an examination of a few of the characters stated in the key, as well as in the additional points of divergence given below. In *G. procera* the disk averages much



Fig. 26. *G. procera*, $\times \frac{1}{5}$; leaves $\times \frac{1}{5}$; habit \times about $\frac{1}{50}$. Fig. 27. *G. nana*, $\times \frac{1}{5}$.

smaller than in *G. camporum* and varieties (except *G. camporum* var. *parviflora*); the involucre bracts are shorter, less firm, and less thickened than in the *G. camporum* group (except *G. camporum* var. *parviflora*); the pappus awns average shorter ($\frac{1}{2}$ – $\frac{3}{4}$ the length of the disk-corolla) and are more slender than in *G. camporum*, and in *G. camporum* they usually equal or nearly equal the height of the disk-corolla; the leaf is much less firm than in *G. camporum*, irregularly crisped, and presents an uneven surface; the stems are usually solitary

and fastigiately branched with several or many closely ascending branches, whereas in *G. camporum*, including most of the varieties, the stems are usually several from the base and mostly corymbosely branched in the upper portions with elongated spreading-ascending floriferous branchlets. The base or the lower portion of the stem in *G. procera* is mostly finely puberulent, while it is glabrous (except the pubescent-stemmed varieties) in *G. camporum*. In the seedling stages the cotyledons are shorter and the rosette leaves shorter, narrower, and more pubescent in *G. procera* than in *G. camporum*. It is of interest, too, that the chromosome numbers differ; in *G. procera* we find a diploid with 6 and 12 chromosomes in the X and 2X number, respectively, while in *G. camporum* we encounter a tetraploid having 12 and 24 chromosomes respectively.

Grindelia procera is dominant in the upper San Joaquin Valley and the Tulare and Buena Vista Lake areas, and ranges north to the San Francisco Bay area where it reaches its northern limit in Marin Co. Around the lower San Joaquin and lower Sacramento Valleys *G. camporum* is dominant, and north of the lower San Joaquin Valley it is entirely replaced by its varieties, mostly *G. camporum* var. *Davyi*.

32. *G. humilis* Hook. & Arn. Bot. Beechey Voy. 147. 1833; DC. Prodr. 7: 278. 1838; Torr. & Gray, Fl. N. Am. 2: 248. 1842, as to name and bibliographical reference only; Gray in Geol. Surv. Cal. Bot. 1: 304. 1876; Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888; Greene, Fl. Franc. pt. 4. 363. 1897.

G. robusta Nutt. var. *angustifolia* Gray in Geol. Surv. Cal. Bot. 1: 304. 1876; Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as synonym of *G. cuneifolia*.

G. cuneifolia of most authors, not Nutt.; Gray in Geol. Surv. Cal. Bot. 1: 304. 1876, as synonym; Greene in Coulter's Bot. Gaz. 8: 256. 1883; acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, in major part, and excluding plants from Santa Barbara; acc. to Greene, Man. Bot. San Franc. Bay Reg. 172. 1894, in major part; acc. to Greene, Fl. Franc. pt. 4. 363. 1897, in major part; acc. to Jepson, Fl. W. Mid. Cal. 555. 1901, and ed. 2. 462. 1911, in major part; acc. to Hall in U. Cal. Publ.

Bot. [Compos. S. Cal.] **3**: 38. 1907, as to description, excluding "bracts with tips . . . recurved" and plants from Los Angeles Co.; acc. to Perredes, Wellcome Res. Lab. Bull. 65: 4. *pl. 1. fig. 6.* 1907; acc. to Jepson, Man. Fl. Pl. Cal. 1021. 1925, in major part.

Almost fruticose perennial; stems woody up to about 1 meter, with 1 to several furrowed woody branches 5 cm. or less in diameter, giving rise each season mostly from above to subherbaceous shoots, below usually producing short leafy shoots, the entire plant up to 1½ m. tall, flowering shoots buff or dull brownish above, rufous-fulvous-brown below, glabrous, mostly paniculately branched with many elongated multiflorous branchlets; leaves coriaceous, dark olive or pale green, scarcely resinous, main cauline mostly remotely serrulate or crenate-serrulate with broad short teeth, to subentire, 1–8 cm. long, 0.1–1.4 cm. broad, 4–7 times longer than broad, oblong-ob lanceolate, spatulate-oblong, lanceolate to linear, acute or obtuse, subamplexicaul or about as broad at the base as at the middle, glabrous; heads radiate, 3–4 cm. broad; disk campanulate-hemispherical, 0.8–1.3 cm. high, 1.2–2.2 cm. broad; involucre moderately resinous, 5–6-seriate, bracts usually erect and appressed, 3–8 mm. long, mostly lanceolate with acute to acuminate tips, the upper third to sixth free with usually straight short flattened, ascending to spreading, or slightly reflexed tips; rays 16–34, bright yellow or orange-yellow, the lamina narrowly oblong-spatulate, obtuse, mostly 12–17 mm. long; achenes oblong, grayish to fulvous-brown, 5–7



Fig. 28. *G. humilis*. $\times \frac{1}{5}$.

mm. long, 1.5–3 mm. broad, smooth to roughened or slightly winged on angles and dorsal face, at maturity undulately bordered at the apex with 2–3 broad coronal projections; awns 2–3 to the floret, mostly remotely serrulate to subentire, 3–5 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: salt marshes, tidal flats and estuaries associated with *Salicornia ambigua*, common around the San Francisco Bay region, San Pablo Bay, Bolinas Bay, and north to Tomales Bay, western middle California.

CALIFORNIA: islands and coast of Bay, salt marshes, near San Francisco, 1866, *Kellogg* (G, US); salt marshes, Palo Alto, Sept. 19, 1915, *Stinchfield* 252 (NY); salt marshes along the Bay of San Francisco, Oakland, Sept. 6, 1880, *Engelmann* (M); salt marsh, Kentfield, Marin Co., July 20, 1930, *Rose* in part (CAS, E); Palo Alto, Santa Clara Co., Sept. 14, 1901, *Baker* 47 (CAL, CAS, G, M, MA, NY, PO, US); Cooley's Landing, San Mateo Co., near Palo Alto, Aug. 19, 1927, *Blake* 10328 (G); San Francisco, 1868–9, *Kellogg & Harford* 403 (G); salt marsh, Redwood City, San Mateo Co., Dec. 16, 1914, *Eastwood* (CAS); salt marshes, South San Francisco, San Mateo Co., Aug. 7, 1931, *Moore & Steyermark* 3684 (M); salt marsh, near San Francisco, 1863, *Bolander* 2425 (US); "California, *Hooker & Arnott* (Botany Beechey Voyage)" (CAL, G, US photograph of TYPE, G tracing of TYPE, CAL fragment of TYPE).

32a. f. reflexa Steyermark, f. nov.³²

G. cuneifolia Nutt. acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, in small part, at least as to plant of *Greene* and excluding plants from Santa Barbara; acc. to Greene, Man. Bot. San Franc. Bay Reg. 172. 1894, in small part; acc. to Greene, Fl. Fran. pt. 4. 363. 1897, in small part; acc. to Jepson, Man. Fl. Pl. Cal. 1021. 1925, in small part.

Involucral bracts with tips more subulate and strongly reflexed or recurved to revolute, upper $\frac{1}{3}$ – $\frac{3}{8}$ free and reflexed for 1.5–4 mm. their length.

Distribution: San Francisco, San Pablo, Tomales, and Bolinas Bay region, often occurring with the species, mostly absent on the western portion of the San Francisco Bay, well developed in the Alameda and Oakland marshes.

CALIFORNIA: Alameda marsh, Aug. 7, 1921, *Eastwood* 11049 (CAS COTYPE); tidal flat at mouth of Rodeo Creek, Contra Costa Co., Oct. 8, 1932, *J. T. Howell* 10796 (CAS, M); Oakland salt marsh, Nov. 15, 1883, *Greene* (G TYPE); Alameda marshes, Nov. 12, 1904, *H. M. Hall* 5720 in part (CAL, PO); vicinity of Berkeley, July–

³² *G. humilis* f. *reflexa* Steyermark, f. nov., bracteis involucri cum apicibus subulterioribus et valde reflexis vel recurvis.—Collected in Oakland salt marsh, Nov. 15, 1883, *E. L. Greene* (Gray Herb. TYPE).

Sept., 1906, *Walker 436* (CAL, PA, PO); salt marsh, 2 mi. west of Marin-Sonoma Co. line, Marin Co., at n. end of San Pablo Bay, Oct. 5, 1930, *J. T. Howell 5524* (CAS); near West Oakland, Sept., 1892, *Tidestrom* (CAL, MU).

32b. f. pubescens Steyermark, f. nov.³³

Stems densely hirtellous-pubescent to villous.

Distribution: tidal flat on Napa River, Napa Co., and at Richmond Ferry, California.

CALIFORNIA: upper edge of tidal flat, Cuttings Wharf, on Napa River, Napa Co., Oct. 8, 1932, *J. T. Howell 10805* (CAS TYPE, M isotype); rocky clay bluff above Richmond Ferry slip, *McMinn 138* (ST).

It might be expected that the common plant of salt marshes of San Francisco Bay would have been properly identified before the present time, but heretofore all authors have referred it to *G. cuneifolia* Nutt. However, as will be presently shown, the proper name for this species must become *G. humilis* Hook. & Arn., while *G. cuneifolia* Nutt., not authors, becomes a synonym of *G. rubricaulis* var. *robusta* (*G. robusta*). The chief factor responsible for the misinterpretation of this species is the fragmentary condition of the type specimens of both *G. cuneifolia* and *G. humilis*. The present author has been able to identify both these fragments with certainty only after four years of monographic work on this group, which has involved a careful comparison of many specimens of herbarium and living material with the type collections of *G. humilis* and *G. cuneifolia*.

The description of *G. humilis* by Hooker and Arnott³⁴ was unfortunately based on a specimen less than a foot tall which supposedly had the "stems herbaceous." Since the common salt-marsh plant of San Francisco Bay has woody stems and is almost a fruticose type, its identity with *G. humilis* was never suspected, except by Greene³⁵ who, in his 'Flora Franciscana' in 1897, stated, at the end of his treatment of *Grindelia*, that

³³ *G. humilis* f. *pubescens* Steyermark, f. nov., caulibus dense hirtello-pubescentibus vel villosis.—Collected at upper edge of tidal flat, Cuttings Wharf, on Napa River, Napa Co., California, Oct. 8, 1932, *J. T. Howell 10805* (Cal. Acad. Sci. Herb. no. 198266 TYPE, M isotype).

³⁴ Hooker, W. J. & Arnott, G. A. W., Bot. Beechey Voy p. 147. 1833.

³⁵ Greene, E. L., Fl. Franc. pt. 4. 363. 1897.

"*Grindelia humilis*, H. & A., is based on an abnormal twig broken off from a shrubby species and described as a small herb." Greene is to be praised for his keen insight into the situation here, because all other authors were unable to identify the fragmentary material. Gray,³⁶ in the 'Synoptical Flora,' had not the slightest idea of what constituted *G. humilis* and described it as a valid species under a separate section as, "anomalous and obscure species" Following his description, he added³⁷: "Single specimen known, 'California, Beechey,' therefore probably from Monterey. Very unlike any other." There is no data on the type sheet of *G. humilis* to indicate whether Lay and Collie, who collected most of the plants on the Beechey expedition, obtained *G. humilis* at San Francisco or at Monterey Bay. However, on p. 134 of the 'Botany of the Beechey Voyage,'³⁸ under the heading "California," we find a short explanatory note as to localities where the Californian collections were taken, namely, "collected at San Francisco and a few at Monterey Bay." The author has made a study of a fragment and photograph of the type with accompanying notes obtained by the late Dr. H. M. Hall, of the Carnegie Institution, and preserved in the Herbarium of the University of California, and has been able to identify the type plant of *G. humilis*, fragmentary as it is, with the common salt-marsh plant of the San Francisco Bay. Fortunately, the single head preserved on the type shows the lanceolate, acute to acuminate, erect appressed involucral bracts characteristic of the common form of the San Francisco Bay species. The single pappus awn included in the preserved fragmentary material is subentire, which is characteristic of the salt-marsh plant of San Francisco Bay. An examination of many herbarium specimens of this species brings to light several collections in which the arrangement, size, and shape of the leaves match the type plant perfectly. This fragment, as Greene suggested, represents a broken-off herbaceous flowering branch from a taller suffrutescent plant. Short lateral flowering shoots in this spe-

³⁶ Gray, A., Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888.

³⁷ Gray, A. *Ibid.*

³⁸ Hooker, W. J. & Arnott, G. A. W., Bot. Beechey Voy. p. 147. 1833.

cies are regularly produced from base to apex of the older ligneous portions, and to those acquainted with the habit of growth of this salt-marsh species the fragment collected by Lay and Collie is not unusual or even an abnormal shoot but one which might be collected at any time. Undoubtedly, this fragment of *G. humilis* was taken in the San Francisco region where the species in its typical form is common in salt marshes along the Bay, as at "South San Francisco," where the present writer first collected it. It was certainly never collected around Monterey Bay, as Gray assumed, since no species with the morphological characters of the *G. humilis* type specimen is known from that locality.

It is unfortunate that this species, one of the tallest (a meter or more tall) and the most fruticose of the genus, must bear the wholly inappropriate name, *G. humilis*.

33. *G. paludosa* Greene, Man. Bot. San Franc. Bay Reg. 172. 1894; Fl. Franc. pt. 4. 363. 1897.

G. cuneifolia Nutt. var. *paludosa* (Greene) Jepson, Fl. W. Mid. Cal. 556. 1901; Man. Fl. Pl. Cal. 1021. 1925.

Herbaceous perennial; stems subcorymbosely branched, buff or stramineous to suffused with pinkish-purple, glabrous, 0.5–1.5 m. tall; leaves subentire, remotely denticulate with broad short teeth, to coarsely and closely saliently or crenately dentate or serrate, broadly oblong or ovate to ovate-lanceolate or lanceolate, acute, strongly amplexicaul, the main middle and upper cauline 4–10 cm. long, 1.5–4.5 cm. broad, $2\frac{1}{4}$ –4 times longer than broad, those on the floriferous branchlets 1.5–3.5 cm. long, 0.5–1.0 cm. broad, subcoriaceous, lower leaves produced on basal sterile or first-year shoots, entire to crenate near apex, broadly spatulate to obovate, narrowed but amplexicaul at base; heads radiate; disk campanulate-hemispherical, 0.7–1.1 cm. high, 0.8–2.0 cm. broad; involucre slightly to moderately resinous, the bracts with reflexed or deflexed to slightly revolute or sometimes spreading tips, glabrous, broadly lanceolate with rather abruptly acuminate to short caudate tips, or the outermost more narrowly lanceolate with short subulate

tips, 5.5–20 mm. long; lamina of rays 12–18 mm. long, bright yellow or orange-yellow; achenes oblong, dull brown, 3.5–6.8 mm. long, 1.5–2 mm. broad, smooth to roughened on margins or angles; awns 2–5 to floret, subentire to remotely serrulate, 3–4.6 mm. long, $\frac{1}{2}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: brackish marshes about Suisun Bay and in vicinity of Suisun, western middle California.

CALIFORNIA: from the type plant in the Botanic Garden, Berkeley, Nov., 1894, *Davy* (CAL); from type plants, Bot. Garden, Berkeley, Nov. 7, 1895, *Jepson* (CAL, G, MU, NY, R); type locality, Suisun marsh along the railroad near Suisun, Sept. 21, 1904, *Heller 7542* (CAL, G, M, MA, NY, PA, US); Suisun marshes, Sept., 1897, *Davy* (CAL, PO); Suisun, Solano Co., alt. 10 ft., Oct. 9, 1932, *Booth 2063* (E); Suisun marsh, Sept. 29, 1889, and Oct. 30, 1892, *Greene* (N TYPE collection); Suisun marshes, Solano Co., Oct. 15, 1905, *Dudley* (ST); salt marsh, Suisun, Solano Co., Sept. 17, 1933, *J. T. Howell 11670* (CAS, M); salt marsh at Suisun, Solano Co., Nov. 19, 1933, *J. T. Howell 11724* (CAS, M); Suisun marshes at Pierce Station, Solano Co., Nov. 19, 1933, *J. T. Howell 11727* (M) and *11728* (CAS).

This entity has been much confused since its original publication in 1894. Although described³⁹ as a plant “about 5 ft-high, sterile leafy shoots a foot high or more, surviving the winter, the plant otherwise herbaceous,” Greene nevertheless placed this species with the fruticose-stemmed *G. cuneifolia* of authors (*G. humilis* Hook. & Arn.), under the section “suffrutescent species.” Examination of herbarium specimens of the type collection and of the plants cultivated from the type plants at the University of California Botanical Garden at Berkeley shows that the stems are herbaceous. Detailed field investigation of *G. paludosa* in the Suisun marshes, the type locality, graciously carried on by Mr. J. T. Howell, of the California Academy of Sciences, and the growing to maturity by the writer of several hundred plants from seed from various areas within the type locality prove definitely that the stems of this species are strictly herbaceous, arising directly from the crown of the perennial tap-root. In habit, therefore, this species is quite different from the woody-stemmed *G. humilis*, and cannot logically be considered a variety of that species, as some authors have done (calling it *G. cuneifolia* var. *paludosa*).

³⁹ Greene, E. L., Man. Bot. San Franc. Bay Reg. 172. 1894; and Fl. Franc. pt. 4. 363. 1897.

It would seem that *G. paludosa* is of hybrid origin, and comprises within the Suisun marshes plants of varying degrees of hybridity. Many of the *G. paludosa* plants collected in this area appear to be hybrids between *G. camporum* and *G. humilis* f. *reflexa*, while others appear to be hybrids between *G. humilis* f. *reflexa* and *G. camporum* var. *parviflora*, or *G. camporum* var. *Davyi* and *G. humilis*, and still others between *G. procera* and *G. humilis* or f. *reflexa*. Most of the entities mentioned are found in the vicinity of the Suisun Bay and marshes. Mr. J. T. Howell has observed and collected both *G. camporum* and var. *parviflora* around this area in southern Solano Co. and Contra Costa Co. The collections of *G. camporum* (*J. T. Howell* 4322 near Rodeo, *Rose's* collection of 1930 near Pittsburg, *J. T. Howell* 11692 from Collinsville at edge of marsh), of *G. camporum* var. *parviflora* (*J. T. Howell* 11721 from Ignacio, and *J. T. Howell* 11729 from Benecia), and of *G. camporum* var. *Davyi* (*Rose's* collection of 1930 from Antioch Bridge) show that the species and vars. *parviflora* and *Davyi*, are at or near localities inhabited by *G. humilis* f. *reflexa*; and since *G. camporum* (for example, *J. T. Howell* 11692 collection from Collinsville) and *G. camporum* var. *parviflora* (*J. T. Howell* 11721 collection from Ignacio and 11729 from Benecia) may occur around brackish water in marshes which are inhabited by *G. humilis* f. *reflexa*, it is quite natural that hybrids should exist in these areas. Specimens of *G. paludosa* collected in the Suisun marshes by J. T. Howell (nos. 11723, 11724, 11726, 11727, 11670, and 11671) show various degrees of variation in leaf shape and serration. Some (no. 11723 and 11726) have the leaves entire or subentire, exhibiting some of the *G. humilis* and f. *reflexa* ancestry, whereas others with more sharply serrate leaves show the dominance of the *G. camporum* character. The strongly amplexicaul bases of the upper leaves of some collections from the Suisun marshes (as one of the type collections made by Greene on Oct. 30, 1892, specimens collected from type plants by Jepson on Nov. 7, 1895, and by Burtt-Davy in Oct., 1895, *Heller* 7542 and *Howell* 11670) manifest the *G. camporum* ancestry, while others with narrower upper

leaves, not so conspicuously broadened at the base (as *J. T. Howell* 11723 and 11671 and others) show more the *G. humilis* tendency. The collection of *J. T. Howell* 11671 could be equally considered a hybrid between *G. humilis* and *G. procera* as it could between *G. humilis* f. *reflexa* and *G. camporum* var. *parviflora*.

Grindelia paludosa has leaves intermediate in texture between *G. humilis* and *G. camporum*, although the texture tends more towards the coriaceous type of *G. humilis*. The involucral bracts resemble in position, shape, length, and texture those of the *G. humilis* group more than *G. camporum*. The pappus awns, in their degree of remote serrulation, also suggest those of the *G. humilis* group. In the matter of the smaller degree of resinous output, *G. paludosa* shows a stronger resemblance to *G. humilis*.

Since it shows such points of resemblance to both the *G. humilis* and the *G. camporum* group, and in some characters is intermediate between the two although in most respects simulating more *G. humilis* and f. *reflexa*, and since it occurs in an area shared by both species, *G. paludosa* should be considered a youthful species of modern hybrid origin (Post-Pleistocene, because it inhabits brackish marshes not formed until after the drowning and subsidence of the lower San Joaquin and lower Sacramento Rivers, a process which has been going on into modern times). It is a nascent species, just beginning, sometimes appearing more like *G. camporum* and other times like *G. humilis*. Moreover, it cannot be considered a variety of either of these species, because it combines characteristics found in both.

34. *G. camporum* Greene, Man. Bot. San Franc. Bay Reg. 171. 1894; Fl. Franc. pt. 4. 361. 1897; Jepson, Fl. W. Mid. Cal. 555. 1901, and ed. 2. 462. 1911; Abrams, Fl. Los Ang. & Vic. 393. 1904, and ed. 2. 360. 1917, in large part, excluding plant from Wiseburn; Jepson, Man. Fl. Pl. Cal. 1021. 1925.

G. robusta var. *rigida* Gray in Geol. Surv. Cal. Bot. 1: 304. 1876, in part; Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 119. 1888, in part, as synonym of *G. robusta*.

G. squarrosa (Pursh) Dunal acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, in part, as to plants from California.

Herbaceous perennial; stems usually several, stout, corymbosely much-branched above the middle with strongly divergent ascending many-headed branchlets, usually white, stramineous or buff, glabrous, 0.5–1.5 m. tall; leaves subcoriaceous, dark green or bright green, conspicuously resinous-lustrous on the surface, mostly saliently dentate or serrate with sharp acute to subspinulose teeth, 0.7–9 cm. long, 0.4–3 cm. broad, 2–4 times longer than broad, obovate to broadly or ovate-oblong, subamplexicaul, those on the elongated floriferous branchlets much reduced, typically ovate or ovate-oblong to broadly oblong-lanceolate, acute to acuminate, strongly amplexicaul, glabrous (except for the scabridulous margins); heads radiate, 2.5–3.5 cm. broad; disk depressed-hemispherical, 0.8–1.5 cm. high, 1.1–2.5 cm. broad; involucre abundantly resinous, 5–6-seriate, bracts 6–11 mm. long, lanceolate with elongated subulate subterete thickened tips, the upper $\frac{1}{3}$ – $\frac{5}{8}$ of the bracts free and loosely spreading to deflexed; rays 18–39, bright yellow or lemon-yellow, the lamina 8–11 mm. long; stigmas linear or narrowly linear-lanceolate; achenes broadly oblong, 3–5 mm. long, 1.5–2.5 mm. broad, stramineous or dull brown, striated or irregularly furrowed or smooth, 2–3-knobbed, toothed, or auriculate at apex, these sometimes more prominent at one portion; awns 2–3 to the floret, stout, entire to subentire, 4–7 mm. long, $\frac{3}{4}$ to equalling length of disk-floret.

Distribution: alluvial river-bottoms, arid rocky flats, dry gravelly washes along creeks, dry clay slopes, and along roadsides, along the lower Sacramento River Valley region and the valley lands about San Francisco Bay, where common, southwards following the San Joaquin River and valleys to Mariposa and Tulare Counties, central California; introduced around Los Angeles, California, Nevada, and Pennsylvania.

PENNSYLVANIA (Introduced): on ballast, Philadelphia, Aug. 1878, 1879, and 1880, *Martindale* (MU, US), and June 13, 1880, *Martindale* (G); ballast, Philadelphia, June 13, 1880, *Parker 1285a* (M).

NEVADA: dry hills, vicinity of Austin, alt. 1950 m., July 25, 1913, *A. E. Hitchcock 661* (US).

CALIFORNIA: roadside, 6 miles west of Tracy, Contra Costa Co., alt. 50 m., Aug. 7, 1931, *Moore & Steyermark 3683* (M); Antioch, Sept. 5, 1881, *Greene* (M); Golden Gate Park, 1881, *Greene* (N); Monte Diablo, 1860–62, *Brewer 850* (G, US);

Antioch, June, 1884, *T. S. Brandege* (CAL); clay soil on roadside, 4 miles west of Clayton, Contra Costa Co., Sept. 21, 1929, *J. T. Howell 4387* (CAS); San Joaquin Valley between Visalia and Exeter on Raweal Road, July 31, 1915, *Abrams 5393* (ST); Liberty School on Marsh Creek Road, Contra Costa Co., Sept. 28, 1930, *J. T. Howell 5459* (CAS); Pittsburg, Contra Costa Co., July 22, 1930, *Rose* (CAS); dry gravelly wash of Mocho Creek, Livermore Valley, Alameda Co., Oct. 16, 1932, *J. T. Howell 10827* (CAS, M); Banta, San Joaquin Co., Sept. 9, 1892, *Bioletti* (CAL); 1868-9, *Kellogg & Harford 404* (G, NY); Los Angeles, near U. C. L. A., on Berendo Street, Nov. 13, 1928, *J. T. Howell 4090* (CAL, CAS); Merced, July 26, 1923, *Eastwood* (CAS); alkali country, 3 miles southwest of Merced, Merced Co., May 9, 1925, *J. T. Howell 1015* (CAS).

34a. var. *parviflora* Steyermark, var. nov.⁴⁰

Stems 1.1-1.8 m. tall, much-branched above with very elongated ascending many-headed branchlets; leaves conspicuously and abundantly resinous, lustrous, middle and upper saliently dentate, 1-6 cm. long, 0.5-2.5 cm. broad, 1½-3 times longer than broad, oblong to broadly oblong, obtuse to acutish, amplexicaul, those on floriferous branchlets saliently dentate or denticulate, ovate to broadly lanceolate, acute to obtuse; heads about 1.5 cm. broad; disk mostly 0.6-1.0 cm. high, 0.7-1.5 cm. broad; involucre conspicuously and abundantly resinous, the upper ⅓-⅕ of the bracts free and squarrose to slightly deflexed, lanceolate with acuminate to short subulate somewhat thickened and subcoriaceous tips; rays 16-18, the lamina 7-8 mm. long; achenes broadly oblong, 4-5.2 mm. long, 2-2.3 mm. broad, stramineous or light brown, conspicuously 2-3-knobbed, toothed or undulately bordered at apex; awns 3-4 mm. long.

Distribution: low or alluvial ground along streams and roadsides, Marin, Alameda, Contra Costa and Solano Counties, in region of San Francisco Bay, California.

⁴⁰ *G. camporum* var. *parviflora* Steyermark, var. nov., caulibus 1.1-1.8 m. altis, robustis, supra valde ramosis, ramusculis elongatissimis, adscendentibus, multicapitulatis; foliis abundanter et valde resinosis, in ramusculis floriferis valde reductis, foliis mediis et superioribus 1-6 cm. longis, 0.5-2.5 cm. latis, 1½-3 plo longioribus quam latis, oblongis vel late oblongis, amplexicaulibus, salienter dentatis; capitulis ca. 1.5 cm. latis; disco plerumque 0.6-1.0 cm. alto, 0.7-1.5 cm. lato; involucreo abundanter et valde resinoso, bracteis 3-7 mm. longis, parte superiore libera et squarrosa vel paulum deflexa; ligulis 16-18, 7-8 mm. longis; achaeniis late oblongis, 4-5.2 mm. longis, 2-2.3 mm. latis, apicibus 2-3-dentatis; aristis 3-4 mm. longis.—Collected at Liberty School on Marsh Creek Road, Contra Costa Co., California, Sept. 28, 1930, *J. T. Howell 5496* (Cal. Acad. Sci. Herb. no. 187935 TYPE, D, M, isotypes).

CALIFORNIA: Cedar Mt. Ridge, Alameda Co., Nov. 29–30, 1907, *Forbes* (CAL); Patterson Pass, east side, Contra Costa Co., Sept. 13, 1917, *Abrams* 6727 (NY); Ignacio, Marin Co., Nov. 19, 1933, *J. T. Howell* 11721 (M); Benecia, Solano Co., Nov. 19, 1933, *J. T. Howell* 11729 and 11730 (M); low valley land, perhaps alkaline, Marsh Creek Road, 3.5 miles southwest of Brentwood, Sept. 21, 1929, *J. T. Howell* 4396 (CAS); Liberty School on Marsh Creek Road, Contra Costa Co., Sept. 28, 1930, *J. T. Howell* 5496 (CAS TYPE, D, M, isotypes).

34b. var *australis* Steyermark in Ann. Mo. Bot. Gard. **21**: 228. 1934.

G. camporum Greene acc. to Hall in U. Cal. Publ. Bot. [Compos. S. Cal.] **3**: 39. 1917, only as to plant of *Hall* 6719 from Elizabeth Lake, Los Angeles Co.

Stems glabrous, 3–7 dm. tall, branched above with short rather closely ascending floriferous branchlets bearing few to many heads often crowded near the tips; leaves conspicuously resinous-punctate, the main middle and upper cauline saliently denticulate to spinulose-denticulate, 3–7 cm. long, 1–2.5 cm. broad, 2–4 times longer than broad, oblong or ovate-oblong to ovate, strongly amplexicaul; disk 1–1.3 cm. high, 1.2–2 cm. broad; involucre bracts strongly reflexed to revolute; lamina of ray-floret 7–9.5 mm. long.

Distribution: dry slopes and open banks, vicinity of Tehachapi Pass, Kern Co., and about Elizabeth Lake and Santa Susanna Mts., Los Angeles Co., southern California.

CALIFORNIA: Cameron, alt. 3800 ft., July 24, 1900, *M. E. Jones* (PO); Elizabeth Lake, Los Angeles Co., July, 1905, *Hall* 6719 (CAL); base of dry slope, 3 miles east of Elizabeth Lake, Los Angeles Co., Sept. 4, 1928, *Munz & Johnston* 11157 (PO TYPE); open bank, Elizabeth Lake, northern Los Angeles Co., July 9, 1928, *Hoffmann* (SB); Tehachapi Valley, Kern Co., alt. 1250 m., June 25, 1891, *Coville & Funston* 1116 (US); Tehachapi Pass, Kern Co., June 28, 1905, *Grinnell* 412 (US); Tehachapi, Kern Co., Sept. 29, 1894, *Eastwood* (G); Santa Susanna Mts., Los Angeles Co., June 16, 1916, *Moxley & Grinnell* 495 (ST).

Aside from the more recurved or sub-revolute tips of the involucre bracts and more closely crowded heads on shorter branches, this variety resembles typical *G. camporum*.

34c. var. *abbreviata* Steyermark in Ann. Mo. Bot. Gard. **21**: 228. 1934.

Stem solitary, simple below, slightly branched near top with few short floriferous branchlets; leaves subcoriaceous,

conspicuously resinous-punctate; disk small, 0.8–1 cm. high. 1–1.2 cm. broad; involucral bracts 2–8 mm. long, the tips only 1.5–2.5 mm. long, slightly spreading or ascending, lanceolate, acuminate to short-subulate; awns about 4 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: vicinity of Lancaster, Los Angeles Co., southern California.

CALIFORNIA: alkaline flats, Lancaster, Los Angeles Co., Sept. 23, 1927, *Hoffmann* (SB TYPE).

34d. var. Davyi (Jepson) Steyermark, comb. nov.

G. robusta Nutt. var. *Davyi* Jepson, Fl. W. Mid. Cal. 554. 1901, and ed. 2. 462. 1911; Man. Fl. Pl. Cal. 1020. 1925.

G. robusta var. *rigida* Gray in Geol. Surv. Cal. Bot. 1: 304. 1876, in part; Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888, in part as synonym of *G. robusta*.

G. squarrosa (Pursh) Dunal acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 119. 1888, in part as to plants from California.

Stems usually several, generally more slender than in the species, sparsely corymbosely branched with ascending few-headed branchlets, purplish- or brownish-red to stramineous, glabrous, mostly 0.35–0.75 m. tall; leaves usually somewhat thinner than in the species, saliently serrate or dentate to sub-entire, 2–12 cm. long, 0.3–2 cm. broad, 4–10 times longer than broad, narrowly oblanceolate to oblong or oblong-lanceolate and acute, subamplexicaul, those on floriferous branchlets typically linear-oblong to lanceolate, not conspicuously reduced.

Distribution: dry grassy or rocky slopes in mountainous or hilly country, along creeks and river courses, dry fields and roadsides, northern and north-central California from Modoc Co. south along the western slopes of the Sierra Nevadas to Tulare Co., and along the Coast Range from Humboldt Co. south to Alameda and Contra Costa Co. and along the Sacramento River and its tributaries in northern California.

CALIFORNIA: Pachecos Pass near Camp 77, June 19, 1862, *Brewer 1290* (G, US); Berkeley, *King* (CAL); near Madison, Yolo Co., May 31, 1903, *Heller & Brown 5578* in part (G, PA); Mt. St. Helena at timber line, Sept. 23, 1893, *Jepson* (CAL); field, 2 mi. north of Placerville, Eldorado Co., Oct. 12, 1930, *J. T. Howell 5567* (CAS); Auburn, Placer Co., Oct., 1894, *Ames* (G); near Nevada City, Nevada Co., July 14, 1905, *Heller 8117* (CAL, D, F, G, M, NY, PA, US); near Gautier's Bridge

over Bear River, Nevada Co., July 4, 1913, *Eastwood 3433* (CAS); Lawrence, July 6, 1882, *M. E. Jones 3611* (CAS, M, MA, NY, PO, US); Lakeport, June, 1885, *Rattan* (G); Payne Creek, Lassen Butte region, Tehama Co., Aug. 22-26, 1912, *Eastwood* (CAS); Red Bluff, June, 1917, *Wickes* (CAS); Little Chico Creek, June, 1897, *Austin 1953* (US); dry hillside at Little Chico Creek, alt. 2000 ft., July 5, 1900, *Leiberg 5023* (US); Durham, Butte Co., June 5, 1932, *Morrison* (CAS); Sacramento, Sacramento Co., May 10, 1918, *Hannibal* (ST); Montezuma Hills, Solano Co., Sept. 17, 1933, *J. T. Howell 11684* (CAS, M); east of Chiles Valley on road to Winters, Napa Range, Napa Co., Aug. 27, 1933, *J. T. Howell 11645* (CAS, M); Table Mountain Olive Ranch, north of Oroville, Butte Co., June 4, 1913, *Heller 10780* (CAL, F, G, M, NY, PA, US); Antioch Bridge, Contra Costa Co., July 22, 1930, *Rose* (CAL); Redding, Shasta Co., May 24, 1913, *L. E. Smith* (CAS, US); Kennett, Shasta Co., July 26, 1912, *Eastwood 1464* (CAS, US); valley flat, 5 mi. south of Garberville, Humboldt Co., June 16, 1931, *J. T. Howell 6713* (CAS); vicinity of Ione, Amador Co., alt. 200-500 ft., June, 1904, *Braunton 1007* (CAL, M, NY, US); Caminetti Ranch, near Jackson, Amador Co., alt. 1600 ft., June 1-20, 1904, *Mulliken 113* (CAL, PO, R, US); Murphy's, Calaveras Co., July 2, 1891, *T. S. Brandegee* (CAL); The Geysers, July 5, 1931, *M. E. Jones 29142* (CAL, M); Mark West Creek north of Santa Rosa, Sonoma Co., July 8, 1902, *Heller 5810* (F, G, M, NY, PA, US); in chaparral, 4 mi. from petrified forest on road to Knight's Valley, Sonoma Co., June 30, 1929, *J. T. Howell 4318* (CAS); Peralta Park, Berkeley, June 10, 1896, *Davy* (CAL COTYPE); N. Berkeley, Oct., 1897, *Davy* (CAL); Berkeley, Dec. 4, 1912, *Condit* (CAL).

In placing var. *Davyi* under *G. robusta*, Jepson added to the state of confusion already existing under *G. robusta*. Careful study of living and herbarium material, including the type collections of *G. robusta* var. *Davyi*, proves that this is a common and widespread variation of *G. camporum* which ranges northward from the San Francisco Bay region to northern California. It is unfortunate that Jepson should have based part of his interpretation of *G. robusta* var. *Davyi* on collections around the San Francisco Bay region, such as Davy's collections from Peralta Park, Berkeley, and Walker's 441, because in this region hybridization takes place between *G. camporum* and var. *Davyi*, and some of the collections (such as Walker 441) used as part of a basis of Jepson's concept of var. *Davyi* are somewhat intermediate between *G. camporum* and var. *Davyi*, and may possibly be of hybrid origin. Farther north along the Sacramento River Valley and along the foothills of the Coast Range and western foothill slopes of the Sierra Nevada, the var. *Davyi* is the dominant and typical variation of

the species. It is mostly distinguished from *G. camporum* by its fewer heads on more sparsely branched stems, and by the leaves which are much longer than broad, especially the upper ones, and from forms and varieties of *G. integrifolia* by the more squarrose bracts, the longer and stouter pappus awns which equal or almost equal the length of the disk-floret, and the more conspicuously knobbed achenes.

34e. var. interioris (Jeps.) Steyermark, comb. nov.

G. rubricaulis DC. var. *interioris* Jeps. Man. Fl. Pl. Cal. 1021. 1925.

G. hirsutula Hook. & Arn. acc. to Torrey in Whipple's Exp. Rept. Bot. no. 4. 43. 1857.

Similar to *G. camporum* var. *Davyi*, but stems and often the leaves and involucral bracts villous.

Distribution: dry open hillsides, wooded slopes, valley-land or sometimes along roadsides, occasional along the western slopes of the Sierra Nevadas, northern California, from Amador to Tuolumne Counties, along the Sacramento River Valley in Yolo, Glenn, and Colusa Counties, and Mendocino Co., and south in San Mateo, Sonoma, Santa Clara, and Fresno Counties.

CALIFORNIA: 2 mi. south of Arbuckle, Colusa Co., May 8, 1928, *Abrams 12585* (NY); Stanislaus River, 1853-4, *Bigelow* (NY, US); near Madison, Yolo Co., May 21, 1902, *Heller & Brown 5578* in part (F, M, MA, NY, PO, US); along the highway, 2 mi. south of Arbuckle, Yolo Co., May 12, 1928, *Heller 14557* (NY); Ukiah, Mendocino Co., June 13, 1913, *Eastwood 3317* (CAS); between Hamilton and Orland, Glenn Co., May 1, 1914, *Heller 11351* (CAL, CAS, F, G, M, MU, NY, PA, US); Amador Co., June, 1893, *Cannon* (CAS); Mokelumne Hill, Calaveras Co., May 18-30, 1895, *Davy 1383* (CAL TYPE); dry hillside, Jenny Lind, alt. 250 ft., May 12, 1928, *Stanford 969* (M); Howell Mt., July 19, 1907, *Chandler 7604* (CAL); New York Falls, Amador Co., alt 1000 ft., May 26, 1896, *Hansen 1672* (M, US); occasional in open wooded hills near French Flat, alt. 1400 ft., May 30, 1919, *Williamson 180* (CAS, NY, US); hills on trail to Pine Ridge, Fresno Co., May 29, 1893, *Dudley* (ST); Serpentine hills near Coyote, Santa Clara Co., May 18, 1918, *Ferris 828* (ST).

34f. var. interioris f. foliacea Steyermark, f. nov.⁴¹

Stems buff to salmon, villous-pubescent, especially in upper

⁴¹*G. camporum* var. *interioris* f. *foliacea* Steyermark, f. nov., bracteis involucri omnibus laxis, exterioribus valde elongatis et foliaceis, late patentibus; disco 1.2-1.6 cm. alto, plerumque 1.8-3.2 cm. lato; aristis flores disci subaequantibus, 6-8 mm. longis.—Collected on clay hill, 1 mile from Vacaville on road to Elmira, Solano Co., California, May 30, 1930, *J. T. Howell 5201* (Cal. Acad. Sci. Herb. no. 179831 TYPE, E, G, PO, isotypes).

half; leaves submembranaceous, more or less villous-puberulent (the lower sometimes becoming glabrate), the main lower and middle cauline 5–11 cm. long, 1–1.7 cm. broad; involucral bracts glabrate to villous-hirsutulous, mostly broadly lanceolate with long flattened tips, especially the outer bracts generally becoming much elongated and foliaceous and widely spreading or descending; disk 1.2–1.6 cm. high, mostly 1.8–3.2 cm. broad; awns about as long as disk-floret, 6–8 mm. long.

Distribution: clay hills and ridges, in vicinity of Vacaville, Solano Co., California.

CALIFORNIA: clay hill, 1 mile from Vacaville on road to Elmira, Solano Co., May 30, 1930, *J. T. Howell 5201* (CAS TYPE, E, G, PO); Vacaville, Solano Co., May 6, 1903, *Baker 2916* (CAL, CAS, F, G, M, NY, PO, US).

The production in *G. camporum* and varieties of much elongated and foliaceous outer bracts or of crowded leaves beneath the head is very characteristic, and plants of var. *interioris* f. *foliacea* grown from seed breed true and exhibit the characteristic foliaceous development of the bracts.

The series of variations within the *G. camporum* group is rather involved. *Grindelia camporum* and all varieties, except var. *interioris*, possess an abundance of resin in leaves and involucre, *G. camporum* having the most conspicuous output. The pappus awns of most of the *G. camporum* group nearly equal or surpass the length of the disk-corolla, and are usually decidedly paleaceous (stoutish), characters which should distinguish collections of the *G. camporum* group from any forms of *G. nana*, *G. rubricaulis* or *G. procera*. The elongated narrowly linear style-branches or stigmas found in the *G. camporum* group are also evident in *G. procera* and to some extent in *G. Hallii*, and should differentiate them from forms of *G. hirsutula* or *G. rubricaulis*, both of which possess less elongated and shorter more oblong or oblong-lanceolate stigmas. The elongated terete thickened spreading or deflexed tips of the involucral bracts of the *G. camporum* group are also very characteristic. Difficulty may sometimes exist in differentiating some forms of *G. camporum* var. *interioris* f. *foliacea* from those of *G. hirsutula* f. *patens* or f. *cacumena*, but if the important morphological characters distinguishing the *G. cam-*

porum group from the *G. hirsutula* group are considered, identification should follow readily.

Grindelia camporum var. *parviflora* probably represents a



Fig. 29. *G. camporum*. $\times \frac{1}{6}$;
habit \times about $\frac{1}{40}$.

Fig. 30. *G. Howellii*.
 $\times \frac{1}{6}$.

Fig. 31. *G. integrifolia*.
 $\times \frac{1}{6}$.

hybrid, or is of hybrid origin, between *G. camporum* and *G. procera*; both the latter species have been found in the area inhabited by *G. camporum* var. *parviflora*. *Grindelia cam-*

porum var. *parviflora* possesses the small heads of *G. procera*, but has the larger achenes, firmer resinous leaves, elongated inflorescence, and several or many spreading or divergently branching stems, all characters shared by *G. camporum*. Moreover, the shape and size of the cotyledons and size and serration of the young and basal leaves ally it to *G. camporum*.

35. *G. nana* Nutt. in Trans. Am. Phil. Soc. N. S. **7**: 314. 1841; Torr. & Gray, Fl. N. Am. **2**: 249. 1842, as synonym; Gray, Syn. Fl. N. Am. **1**²: 119. 1884, and ed. 2. 119. 1888, in major part, excluding plants from northwest Wyoming, Idaho, Santa Cruz and Shasta, Cal., and *G. pacifica*; Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 556. 1906, excluding plants of *Henderson*, *Suksdorf*, *Elmer*, *Horner* and *Hardwick*; Henry, Fl. S. Brit. Col. 291. 1915, as to name and partly as to description; Piper & Beattie, Fl. N. W. Coast. 362. 1915, excluding plants from Willamette Valley; Jepson, Man. Fl. Pl. Cal. 1021. 1925, excluding plants from California.

G. nana β *integrifolia* Nutt. in Trans. Am. Phil. Soc. N. S. **7**: 314. 1841; Torr. & Gray, Fl. N. Am. **2**: 249. 1842, as synonym.

G. humilis Hook. & Arn. acc. to Torr. & Gray, Fl. N. Am. **2**: 248. 1842, at least as to "squarrose-recurved appendages," and excluding synonymy.

G. humilis α Torr. & Gray, Fl. N. Am. **2**: 249. 1842.

G. humilis β Torr. & Gray, Fl. N. Am. **2**: 249. 1842.

G. squarrosa var. *grandiflora* (Hook.) Gray acc. to Wats. Bot. U. S. Geol. Expl. 40th Par. [Bot. King's Exp.] **6**: 164. 1871.

Herbaceous perennial; stems several to many, subcaespitose, mostly slender, corymbosely much branched above the middle with numerous ascending floriferous branchlets, light brown to rose-purplish, glabrous, 0.8–6.5 dm. tall; leaves firmly membranaceous, abundantly and conspicuously resinous-punctate, entire to saliently dentate, those on the floriferous branches mostly entire, the main middle and upper cauline 3–9 cm. long, 0.4–2 cm. broad, the middle and lower cauline mostly 5–8 times longer than broad, oblanceolate or spatulate-lanceolate to (the upper) lanceolate, mostly attenuate to a narrowed base, 1–

5 mm. broad at the narrowest basal portion, glabrous; heads radiate, 2–3 cm. broad; disk mostly campanulate-hemispherical to deeply campanulate, 0.7–1.2 cm. high, 0.7–1.8 cm. broad, usually broader than high; involucre conspicuously and abundantly resinous, 5–7-seriate, the bracts 3.5–10 mm. long, lanceolate with subulate and thickened tips, the upper third to fifth strongly reflexed or revolute, 1–3 mm. long, glabrous; rays bright chrome- or lemon-yellow, 11–28, the lamina 5–11 mm. long; achenes narrowly oblong, 3.5–4 mm. long, about 1.5 mm. broad, smooth, light brown, when mature with 1–3 very short knobs or projections at apex; awns 2, slender, 3–5.5 mm. long, mostly entire to remotely serrulate, $\frac{2}{3}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: dry rocky slopes and plains, frequently following river courses, also along roadsides, southern Washington east of the Cascades to northern and central Oregon locally southwest in Curry Co., Oregon, and northern Nevada.

NEVADA: Ruby Valley, alt. 6000 ft., Sept., 1868, *Watson 583* (G, NY, US).

WASHINGTON: roadside, 12 mi. northeast of Dayton, Columbia Co., Aug. 4, 1924, *Larkey* (WSC); Walla Walla, June 30, *Wilkes Exped.* (US); Bickleton, Aug. 1, 1929, *Gotfredson 95* (PO); Belmont, July 19, 1894, *Piper 1833* (R); wash, East Fork of Palouse River, Pullman, Whitman Co., July 17, 1919, *Ferris & Duthie 1269* (R, ST).

OREGON: La Grande, July 28, 1931, *Johnston* (CAS); 8 mi. west of Wapinitia, Wasco Co., June 24, 1928, *Thompson 4945* (M, PA, US); about 2 mi. west of Prairie City, along highway, July 15, 1926, *Babcock & Collins 84* (CAL); bank of John Day River, Clarno, Wasco Co., July 3, 1921, *Peck 10001* (NY); Blue Mts., July, 1902, *Griffiths & Hunter* (NY); dry hillsides, Pelican City, Klamath Co., *Evans 387* (UO); Klamath Falls, 1927, *Lawrence* (O); hot rocky slope at Maupin, Wasco Co., July 3, 1931, *J. T. Howell 7182* (CAS); gravelly hills near Prairie City, Grant Co., July 22, *Cusick 2185* (CAL, F, G, M, MA, MU, PO, R, US); dry situations, eastern Oregon, July 26, 1898, *Cusick 2058* in part (CAL, G, M, MA, MU, PO, US); on rocky lava soil with *Artemisia*, 15 mi. south of Maupin, Wasco Co., alt. 735 m., Aug. 10, 1931, *Moore & Steyermark 3688* (M); roadside, Telocaset, Union Co., July 25, 1921, *Peck 10426* (NY); Vancouver, *Nuttall* (G, PA TYPE collection); Tygh, Tygh Creek, Wasco Co., July 28–30, 1922, *Abrams 9530* (M, PO, R); Wallowa River, 1–6 miles above Minam River, alt. 2925 ft., Aug. 14, 1897, *Sheldon 8699* (M, NY, US); gravel bar along Rogue River, above Gold Beach, Curry Co., June 17, 1926, *Peck 14645* (WI).

35a. f. *Brownii* (Heller) Steyermark, comb. nov.

G. nana Nutt. acc. to Gray, Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888, only as to plant from Idaho (*Wilcox*).

G. Brownii Heller in Bull. Torr. Bot. Club 26: 315. 1899.

Stems taller and stouter than in the species, 5–8 dm. tall; leaves on the floriferous branchlets not so reduced as in *G.*

nana, entire or sparsely serrulate to dentate, the main middle and upper cauline 4–8 cm. long, 0.7–2 cm. broad, the middle and lower cauline 3–6 times longer than broad, the upper broadly lanceolate or oblong-lanceolate with conspicuous subamplexicaul base, the main cauline leaves 4–10 mm. broad at the narrowest basal portion; disk 0.7–1.7 cm. high, 1.2–2.2 cm. broad.

Distribution: dry rocky basalt and granite slopes of canyons and streams, roadsides and along roadside ditches, eastern Washington, Oregon, Idaho, northern Utah, and western Montana.

MONTANA: Crow Creek, July 31, 1900, *Elrod et al* (NY); near Stevensville, Bitter Root Forest Reserve, alt. 1100 m., Aug. 17, 1897, *Leiberg 2903* (US); dry hillsides, Lolo Valley near Lolo, Aug., 1912, *Kirkwood 81* (M).

IDAHO: dry sandy banks of the Clearwater River, below Lapiosi, July 9, 1898, *Henderson 4605* (G); dry clay slope, Salmon, Lemhi Co., alt. 4500 ft., July 3, 1920, *E. B. & L. B. Payson 1883* in part (CAS, R); common at Gilman Ranch, west of Hailey, July 27, 1909, *Woods & Tidestrom 2523* in part (US); Idaho Falls, July 17, 1893, *Ed. Palmer 359* (US); Salmon River bridge, alt. 2600 ft., July 1, 1895, *Henderson 3026* (CAS, US); Blackfoot, Aug., 1892, *Mulford* (M); dry lava soil slopes, Sweet, Boise Co., alt. 3500 ft., Aug. 14, 1911, *Macbride 1652* in part (M, MU, NY, US); Boise City, 1881, *Wilcox* (G); Council, Washington Co., alt. 3000 ft., Aug. 4, 1899, *M. E. Jones* (PO); east of Preston, June 20, 1930, *Davis* (IS); about forest, Nez Perces Co., alt. 3500 ft., July 14, 1896, *A. A. & E. G. Heller 3418* (CAL, M, MA, MU, NY, US, isotypes).

UTAH: Aug. 20, —, Cache Co., *collector lacking* (M); dry lake, Cache Co., Aug. 14, 1929, *Garrett 5380* (GA); dry lake, Cache Co., Aug. 7, 1933, *Garrett 6462* (GA).

WASHINGTON: rocky soil at ferry over Snake River, Franklin Co., alt. 210 m., Sept. 18, 1894, *Leiberg 930* (CAL, G, NY, US).

OREGON: near Echo, Umatilla Co., alt. 320 m., Sept. 16, 1894, *Leiberg 907* in part (G); railroad yards, Albina, July 22, 1917, *J. C. Nelson 1745* (G); along state highway, 15 mi. north of Maupin, Wasco Co., alt. 750 m., Aug. 10, 1931, *Moore & Steyermark 3689* in part (M); bank of Columbia River, near mouth of Des Chutes River, July 30, 1914, *Peck 4910* (WI).

35b. *f. longisquama* Steyermark, f. nov.⁴²

G. oregana Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to plants of *Nuttall* in Gray Herb. and of *Spalding*.

Stems corymbosely branched, 3.3–6 dm. tall; leaves entire to remotely serrulate or denticulate, the upper broadly lanceo-

⁴² *G. nana* f. *longisquama* Steyermark, f. nov., foliis integris, denticulatis vel remote serrulatis, caulinis superioribus late lanceolatis vel oblongis cum basi subamplexicaule; disco quadrato-hemispherico vel profunde campanulato, 1–1.5 cm. alto, 1–2 cm. lato; bracteis involucri cum apicibus liberis, 3–5 mm. longis, parte libera laxa recurva vel valde reflexa.—Collected at Clearwater, Oregon (now Idaho), *Rev. Spalding* (Gray Herb. TYPE, NY isotype).

late or oblong, subamplexicaul, narrowed to 1–7 mm. at the narrowest basal portion; disk mostly quadrate-hemispherical to deeply campanulate, 1.0–1.5 cm. high, 1–2 cm. broad, mostly as high as broad; involucral bracts 5–14 mm. long, the upper half to third free and strongly reflexed or revolute with tips 3–5 mm. long, the inner 10–14 mm. long with conspicuously elongated subulate or filiform free recurved tips; ligules 8–12 mm. long.

Distribution: dry rocky slopes, western Montana, central Washington, eastern Oregon, and Idaho.

MONTANA: dry southern slopes, pine woods, Lolo Valley, Aug., 1912, *Kirkwood* (CAL).

IDAHO: hillsides, Squaw Butte, Boise Co., alt. 3500 ft., Aug. 18, 1911, *Clark 270* (CAL, F, G, M, MU, NY, PO, R, US); dry lava soil slopes, Sweet, Boise Co., alt. 3500 ft., Aug. 14, 1911, *Macbride 1652* in part (CAL, F, G, PO); hillsides, Big Willow, Canyon Co., alt. 3000 ft., May 28, 1910, *Macbride 126* (M, R); stony land, Clearwater, July 4, *Rev. Spalding* (G TYPE, NY).

WASHINGTON: dry ground, Taneum Creek, Kittitas Co., Aug. 6, 1927, *G. N. Jones 639* (US).

OREGON: *Nuttall* (G); near Echo, Umatilla Co., alt. 320 m., Sept. 16, 1894, *Leiberg 907* in part (CAL, NY, US); Blue Mts., 9 mi. w. of Meacham, Umatilla Co., June 22, 1926, *Brunet* (ST); 2 mi. east of Pendleton, Umatilla Co., June 29, 1926, *Brunet* (ST).

35c. var. *altissima* Steyermark, var. nov.⁴³

G. nana Nutt. acc. to Jepson, Man. Fl. Pl. Cal. 1021. 1925, as to plants from California, in part.

Stems one to few, glabrous, 4–11.5 dm. tall, the sparsely corymbosely branched floriferous branchlets elongated, few-headed; leaves entire or subentire, oblong-lanceolate to lanceolate, acute, mostly the same width at the base as at the middle, the main cauline leaves narrowed to 3–5 mm. broad at the narrowest basal portion, glabrous; disk campanulate-hemispherical, 0.9–1.1 cm. high, 1.3–1.8 cm. broad, broader than high; involucre with the upper fourth to half of the bracts strongly

⁴³ *G. nana* var. *altissima* Steyermark, var. nov., caulibus 4–11.5 dm. altis; ramusculis floriferis parce corymboso-ramosis, adscendentibus, elongatis; capitulis paucis, remotis; foliis integris vel subintegris (remote denticulatis); disco campanulato-hemispherico, 0.9–1.1 cm. alto, 1.3–1.8 cm. lato, latiore quam altio.—Collected on gravel bar, Eel River, at mouth of Larabee Creek, Humboldt Co., California, alt. 200 ft., Sept. 12, 1915, *J. P. Tracy 4669* (U. Cal. Herb. no. 186459 TYPE, US isotype).

revolute or strongly reflexed with short subulate tips mostly 1.2–3 mm. long.

Distribution: along creek beds, alluvial ground, and in vicinity of mountains, southwestern Oregon south along the Coast Range country to Napa Range, Napa Co., California.

OREGON: Linkville, Aug. 27, 1897, *Austin* 1614 (PO, US); Oregon, 1893, *Austin* (CAL); sandbar, 2 mi. above mouth of Rogue River, July 8, 1919, *Peck* 8712 (WI); Mule Creek, Rogue River Canyon, Curry Co., Aug. 13, 1913, *Peck* 4912 (WI); Roseburg, June 21, 1916, *Peck* 4917 (WI); Umpqua valley, June, 1887, *T. Howell* (O).

CALIFORNIA: on gravel bar, Eel River, at mouth of Larabee Creek, Humboldt Co., alt. 200 ft., Sept. 12, 1915, *Tracy* 4669 (CAL, US); Round Valley, Mendocino Co., alt. 440 m., July 20–Aug. 3, 1897, *Chestnut* 547 (US); Mount Shasta and vicinity, Siskiyou Co., July 13–27, 1892, *Ed. Palmer* 2551 (US); Sisson, Aug. 14, 1903, *Copeland* 3884 (CAL, CAS, F, G, M, NY, PO); flood bed of Pope Creek, 1 mile below Samuels Springs, Napa Range, Aug. 4, 1929, *J. T. Howell* 4361A (CAS); Pine Hills, July 29, 1915, *Collins & Kempton* 261 (US); Pacific Valley, *T. S. Brandegee* (CAL); Hornbrook, July, 1889, *K. Brandegee* (CAL); Susanville, June 30, 1892, *T. S. Brandegee* (CAL); Ager, July, 1887, *T. S. Brandegee* (CAL); Goose Lake Valley, Modoc Co., Aug., 1886, *Austin* (CAL); Goose Lake Valley, July, 1895, *Austin* 572 (PO, US); Little Hot Spring Valley, Modoc Co., Aug. 18, 1899, *M. S. Baker* (PO).

35d. var. *altissima* f. *puberula* Steyermark, f. nov.⁴⁴

Stems and leaves puberulent.

Distribution: near Ashland, Jackson Co., Oregon, and Lake Co., California.

OREGON: Ashland-Klamath Falls Highway, coming down grade towards Ashland from Green Spring's Mt., July 10, 1930, *Henderson* 13001 (UO); hills near Ashland, July 8, 1886, *Henderson* in part (UO); Ashland, July, 1887, *T. Howell* 741 in part (UO).

CALIFORNIA: dry roadsides, Kelseyville, Lake Co., June 12, 1924, *Blankinship* (CAS TYPE); along streams, Kelseyville, Cold Creek, Lake Co., July 3, 1929, *Blankinship* (M); between Clear Lake and Lower Lake, Lake Co., dry hillside, alt. 1500 ft., May 30, 1926, *Kildale* 2065 (ST).

35e. var. *turbinella* Steyermark, var. nov.⁴⁵

G. nana Nutt. acc. to Jepson, Man. Fl. Pl. Cal. 1021. 1925, as to plants from California, in part.

⁴⁴ *G. nana* var. *altissima* f. *puberula* Steyermark, f. nov., caulibus foliisque puberulis.—Collected on dry roadsides, Kelseyville, Lake Co., California, June 12, 1924, *J. W. Blankinship* (Cal. Acad. Sci. Herb. no. 165247 TYPE).

⁴⁵ *G. nana* var. *turbinella* Steyermark, var. nov., caulibus fastigiate ramosis; foliis integris vel subintegris, caulinis 4.5–7 cm. longis, 0.8–1.1 cm. latis; capitulis parvis; disco turbinato vel profunde campanulato, 0.7–1.1 cm. alto, 0.65–1.1 cm. lato; ligulis 8–10 mm. longis.—Collected in gravelly soil at base of hill, Shasta Valley, 10 miles south of Gazelle, Siskiyou Co., alt. about 3000 ft., Sept. 7, 1917, *Heller* 12579 (Gray Herb. TYPE, CAL, CAS, M, NY, US, isotypes).

Stem solitary, stout, usually fastigiately branched with numerous strongly ascending elongated branchlets, glabrous or infrequently villous-pubescent, 3.5–4.3 dm. tall; leaves essentially entire throughout or subentire, the main cauline 4.5–7 cm. long, 0.8–1.1 cm. broad, mostly 6–7 times longer than broad, narrowly oblanceolate, all attenuated at the base, the middle and lower cauline subpetiolate, glabrous; heads numerous, crowded, 1.2–1.5 cm. broad; disk turbinate or deeply campanulate, 0.7–1.1 cm. high, usually 0.65–1.1 cm. broad, as high as or higher than broad; involucre abundantly resinous, conspicuously imbricated, 6–8-seriate, the upper third to fifth of the bracts free and closely revolute, 3–8.5 mm. long.

Distribution: low open ground, Siskiyou Co., California to southwestern Oregon.

OREGON: Waldo, July 6, 1887, *T. Howell* 742 (G); Kerbyville, July 10, 1887, *T. Howell* 2868 (CAL); near New Pine Creek, Lake Co., alt. 1300 m., July 31, 1896, *Coville & Leiberg* 130 (US).

CALIFORNIA: dry land, roadside near Montague, Siskiyou Co., Sept. 25, 1908, *Butler* 499 (CAL); Verdi, Sept. 1888, *T. S. Brandege* (CAL); Montague, Siskiyou Co., Aug. 13, 1913, *L. E. Smith* 514 (CAS, G, US); Forestdale, Modoc Co., 1898, *M. S. Baker* (CAL); near Edgwood, June 28, 1889, *Lemmon* (CAL); near Yreka, Siskiyou Co., Aug. 12, 1876, *Greene* 974 (F, G, M); Shasta Valley, 10 miles south of Gazelle, in gravelly soil at the base of a hill, alt. about 3000 ft., Sept. 7, 1917, *Heller* 12979 (CAL, CAS, G TYPE, M, NY, PA, US).

35f. var. integerrima (Rydberg) Steyermark, comb. nov.

G. integerrima Rydb. in Bull. Torr. Bot. Club **37**: 128. 1910; Fl. Rocky Mts. 848. 1917.

Stems slender, subcaespitose, 1.5–4 dm. tall; leaves entire to saliently dentate, the main lower and middle cauline oblanceolate to lanceolate-spatulate, narrowed and attenuated at the base; disk small, campanulate-hemispherical, 0.6–1.0 cm. high, 0.6–1.3 cm. broad, mostly broader than high; involucre 5–6-seriate, bracts mostly 2–7 mm. long, lanceolate, the upper fifth to seventh strongly revolute into acuminate or short subulate tips 0.4–1.5 mm. long; awns 2.5–4.5 mm. long.

Distribution: sandy open ground and along sandy roadsides, north- and central-eastern Washington, northern Idaho, northwestern Montana and eastern Montana (where probably introduced).

MONTANA: Whitefish, Sept. 15, 1908, *M. E. Jones* 8517 in part (US); St. Ignatius Mission, alt. 2800 ft., Sept. 4, 1908, *M. E. Jones* 8517 in part (PO); sandy soil, Glendive, Sept., 1892, *Sandberg* (F, MU, R).

IDAHO: sandy soil near Granite Station, Kootenai Co., July 29, 1892, *Sandberg, MacDougal & Heller 784* (CAS, F, G, M, NY TYPE, PA); in the Palouse country and about Lake Coeur d'Alene, July, 1892, *Sandberg* (MU); city limits, Coeur d'Alene, June, 1912, *Rust 223* (US).

WASHINGTON: dry borders of Hangman Creek, Spokane, Spokane Co., July 9, 1892, *Henderson* (UW); near Spangle, Spokane Co., June 28, 1884, *Suksdorf 333* (G, PA, US); sandy open ground, near Spokane, Spokane Co., July 13, 1930, *E. J. Palmer 37831* (M, US); dry ridge, West Medical Lake, Spokane Co., Sept. 28, 1924, *St. John & Warren 6764* (PO); Spokane, Spokane Co., Sept. 5, 1912, *Turesson* (R); Spokane, July, 1898, *Savage, Cameron & Lenocker* (F, M).

OREGON: Union Co., *Cusick 505* (G, US); eastern Oregon, July 26, 1898, *Cusick 2058* in part (F).

35g. var. *Paysonorum* (St. John) Steyermark, comb. nov.

G. Paysonorum St. John in Res. Stud. State Coll. Wash. **12:** 108. 1929.

Stems several, 2.8–4.4 dm. tall; leaves mostly entire or subentire to remotely and shallowly denticulate, the main middle and upper cauline 5–8 cm. long, 1–2.3 cm. broad, 3–5 times longer than broad, the main lower and middle cauline elliptical-obovate or broadly oblong-ob lanceolate to oblanceolate, acutish to obtuse, narrowed to a slender or broad base, 2–7 mm. broad, the upper only slightly reduced in size, broadly subelliptic-oblong to broadly oblong-lanceolate, acute, subamplexicaul to strongly amplexicaul; disk campanulate-hemispherical, 0.9–1.2 cm. high, 1.5–2.2 cm. broad, broader than high; involucre with mostly the upper $\frac{1}{3}$ – $\frac{1}{4}$ of the bracts free and moderately to strongly revolute with a tip 1.5–3 mm. long; ligules mostly 10–14 mm. long.

Distribution: dry, sandy or limey soil, central and west-central Idaho, and sparingly in eastern Oregon and Washington.

IDAHO: sandy hillside, Lime Pt., T32N, R5W, Nez Perce Co., alt. 900 ft., May 9, 1926, *Ransom & Ridout 158* (WSC); dry ground, Lime Pt., T32N, R5W, Nez Perce Co., alt. 900 ft., May 9, 1926, *St. John 4361* (WSC TYPE); dry basalt walls of Snake River Canyon, s. of Zaza, Craig Mts., Nez Perce Co., T31N, R4W, alt. 4800 ft., Oct. 9, 1927, *St. John 9103* (WSC); common at Gilman Ranch, west of Hailey, July 27, 1909, *Woods & Tidestrom 2523* in part (US); dry clay slope, Salmon, Lemhi Co., alt. 4500 ft., July 3, 1920, *E. B. & L. B. Payson 1883* in part (G, M, NY).

WASHINGTON: 5 mi. east of Reardan, Lincoln Co., alt. 856 m., Aug. 14, 1931, *Moore & Steyermark 3690* (M).

OREGON: on rocky lava soil with *Artemisia*, 15 mi. south of Maupin, Wasco Co., alt. 735 m., Aug. 10, 1931, *Moore & Steyermark 3688* (M).

In describing *G. nana* Nuttall⁴⁶ stated that it was nearly allied to *G. humilis* Hook. & Arn. A year later Torrey and Gray,⁴⁷ evidently having a poor understanding of the species in this group, attempted to identify Nuttall's wholly distinct *G. nana*, including the spinulose- and entire-leaved forms, from near Fort Vancouver, Oregon, with the entirely different Californian *G. humilis* Hook. & Arn. Gray⁴⁸ later clarified this enigma by treating *G. nana* as a distinct species from *G. humilis* Hook. & Arn., and the "G. humilis" Torr. & Gray, not Hook. & Arn., became a synonym of *G. nana* Nutt. However, the plant with spinulose-toothed leaves which Nuttall described as the type of *G. nana* from Fort Vancouver, as seen on the lower right corner of the sheet in the Gray Herbarium, is a depauperate specimen with short-tipped involucral bracts, not at all typical of the commoner *G. nana* of that portion of Oregon and Washington; in fact, it much more resembles plants of *G. integerrima* Rydb. which has short-tipped bracts. Granting that Nuttall's specimen was a depauperate individual of the common form in the vicinity of Fort Vancouver and adjacent area and that his β *integrifolia* has the longer bracts typical of the *G. nana* form common in that portion of Oregon and Washington, we should take for the historical *G. nana* the common plant of that portion of Oregon and Washington with longer-tipped bracts, similar to Nuttall's *G. nana* β *integrifolia*, and retain the *integerrima* Rydb. as a variety of *G. nana* for those plants with very short-tipped involucral bracts, occurring in parts of Montana, northern Idaho, north- and central-eastern Washington and adjacent eastern Oregon.

The very confused concept of *G. oregana* Gray, which many authors have attempted to identify with a coastal species ranging from Alaska to California (*G. stricta* DC.), was based in part on material collected in Oregon by Nuttall and from Clearwater, Idaho, by Rev. Spalding; these collections are now included under *G. nana* f. *longisquama*. Since Gray's *G. ore-*

⁴⁶ Nuttall, T., in Trans. Am. Phil. Soc. N. S. 7: 314. 1841.

⁴⁷ Torrey, J. & Gray, A., Fl. N. Am. 2: 248-9. 1842.

⁴⁸ Gray, A., Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888.

gana consisted of such confused elements, as to description, bibliography, synonymy, and specimens labelled and cited *G. oregana*, and since it does not lend itself to clear analysis, it is thought best to treat this name in the sense of a *nomen confusum*, and thus prevent any further distortion in taxonomic delimitation.

36. *G. Howellii* Steyermark, sp. nov.⁴⁹

Stems stout, pale rose-purplish to buff, angled or grooved (especially above), subfastigiately branched above with stoutish somewhat elongated foliose floriferous branchlets bearing several heads, glandular and villous, predominantly glandular, 6.5–8 dm. tall; leaves thin and membranaceous, pale green, scarcely resinous-punctate, the surface mostly dull, remotely dentate or denticulate to entire, the main middle and upper cauline 2.5–7 cm. long, 0.7–2.2 cm. broad, 3–3½ times longer than broad, oblong to broadly oblong-ovate to ovate-lanceolate, acute to acutish, strongly amplexicaul, those on floriferous branchlets numerous, enlarged, and conspicuous beneath the heads, minutely but rather densely glandular or glandular-puberulent; heads radiate, 2.5–3 cm. broad; disk campanulate-hemispherical, 1.1–1.3 cm. high, 1.5–3 cm. broad; involucre moderately resinous, 6–7-seriate, very conspicuously graduated, bracts linear-lanceolate to lanceolate with subulate subterete thickened tips, 3.5–10 mm. long, the upper fourth to fifth free and conspicuously revolute or recurved, the outermost crowded at the base, glabrous; rays 20–28, rather dull yellow or lemon-yellow, the lamina 9–10 mm. long; achenes oblong, 3.5–4.3 mm. long, 1.5–2 mm. broad, stramineous, stri-

⁴⁹ *G. Howellii* Steyermark, sp. nov., caulibus glanduloso-villosis; foliis tenuibus et membranaceis, pallide viridibus, parce resinoso-punctatis, valde amplexicaulibus, illis in ramusculis floriferis parce denticulatis vel integris, ceteris remote dentatis vel denticulatis, caulinis superioribus oblongo-ovatis vel ovato-lanceolatis, acutis, caulinis mediis oblongis, minute sed dense glandulosis vel glanduloso-puberulis; involucre moderatim resinoso, 6–7-seriato, bracteis subteretibus, glabris, parte superiore libera et valde revoluta vel recurvata; aristis 2, plerumque integris vel subintegris, 4–5 mm. longis, disci flores in longitudine ½–⅔ aequantibus.—Collected on dry arid bluff tops, St. Maries River, Kootenai Co., Idaho, Aug. 10, 1894, L. F. Henderson 2791 (Gray Herb. TYPE, R, US, isotypes).

ated or ribbed on the faces, mostly truncate at apex; awns mostly 2 to the floret, slender, entire to remotely serrulate, 4–5 mm. long, $\frac{1}{2}$ – $\frac{2}{3}$ length of disk-floret.

Distribution: dry rocky bluffs, along St. Maries River, Kootenai Co., Idaho.

IDAHO: very dry rocky bluffs and dry, arid level bluff tops, St. Maries River, Kootenai Co., Aug. 10, 1894, *Henderson 2791* (G TYPE, R, US).

This species is dedicated to Mr. John Thomas Howell, of the California Academy of Sciences, who has been of the most invaluable service in procuring seed of *Grindelia*, and in carrying on detailed field work in California. Without his intense interest and coöperation the writer's knowledge of the genus would have been far more imperfect and very incomplete.

37. *G. integrifolia* DC. Prodr. 5: 315. 1836; Torr. & Gray, Fl. N. Am. 2: 248. 1842, mostly as to name only, but excluding synonymy and plants of *Scouler*, *Douglas*, and *Nuttall*; Gray in Geol. Surv. Cal. Bot. 1: 304. 1876, mostly as to name only; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in major part as to description and as to plants of *Howell*, *Hall*, and *Gray*, but excluding synonymy except *Donia inuloides* var. Hook.; Howell, Fl. N. W. Coast. 295. 1900, excluding range in British Columbia; Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906, mostly as to name and description, excluding synonymy and plants of *Piper 3805* and *Tolmie*; Henry, Fl. S. Brit. Col. 291. 1915, mostly as to name only, but excluding synonymy; Piper & Beattie, Fl. N. W. Coast. 362. 1915.

G. villosa Dougl. ex Sweet, Hort. Brit. ed. 2. 299. 1830, and ed. 3. 346. 1839, as nomen subnudum.

Donia villosa Hort. ex Hook. Comp. Bot. Mag. 2: 141. 1836, as nomen nudum; Douglas, Jour. 328. 1914, as nomen nudum.

Donia inuloides β Hook. Fl. Bor. Am. 2: 25. [1834] 1840.

Stems erect, stout, angled, strongly grooved, mostly fastigiate-ly branched above with strongly ascending foliose branchlets bearing few to numerous heads, stramineous or pale buff, glandular-villous, the glandularity especially prominent towards heads, the lower half becoming glabrate, 5–7 dm. tall; leaves membranaceous, mostly pale green, scarcely resinous-punctate, upper and middle cauline entire or sparsely denticu-

late, 2–8 cm. long, 0.7–3 cm. broad, 2–4 times longer than broad, broadly ovate-lanceolate, acute to acuminate, strongly amplexicaul to subcordate, those on the floriferous branchlets enlarged beneath the heads, sparsely glandular-puberulent; disk 0.8–1.2 cm. high, mostly 1–2.7 cm. broad; involucre slightly to moderately resinous, bracts linear- to lanceolate-subulate, 5–12 mm. long, the outer and middle with the upper half to two-thirds free and loosely spreading, involute or arched-spreading or ascending with filiform-subulate tips, mostly glandular-puberulent; rays 16–28, the lamina 8–11 mm. long; achenes oblong, 3–4 mm. long, 1.5–2.3 mm. broad, faintly striate on angles and faces, mostly subtruncate at apex; awns mostly 2–3 to the floret, slender, tapering to a long slender aristate apex, entire to remotely serrulate, 3–4 mm. long, $\frac{1}{2}$ – $\frac{2}{3}$ length of disk-floret.

Distribution: dry slopes, fields, and open places in the Willamette River Valley region, Oregon, from the vicinity of North Yamhill, Yamhill Co., south to vicinity of Albany, Corvallis, and Douglas.

OREGON: "Ex America bor. Occid. Hort. Soc. London, Aug., 1830, Alph. DC." (CAL fragment of TYPE, CAL, G, photographs of TYPE); 1840, *Basil* (US); Jardin des Plantes, 1835, *Herb. J. Gay* (G); wet places, Washington Co., Aug., 1880, *T. Howell* (G, US); North Yamhill, July 8, 1882, *T. Howell* (PA, NY); "e sem." Oregon, Botanic Garden of Harvard Univ., 1873, *E. Hall* (G, US); 1860, *Bipontinus* (G); Corvallis, alt. 400 ft., June 27, 1916, *Gilbert 132* (O, US); Albany, June, *Lemmon* (CAL); Willamette Heights, Portland, June 22, 1902, *Sheldon S. 10665* (F, G, NY, PO, US); 1871, *E. Hall 264* (F, M, NY); dry slopes and pastures, Hood River, July 30, 1884, *Henderson 432* in part (M); Corvallis, alt. 235 ft., July 19, 1920, *Gilkey 79* (O); roadside banks, open fields, Pacific Highway, near Douglas, Lane Co. boundary, alt. 750 ft., June 10, 1926, *Ingram 2083* (O); bar along Willamette River, Salem, *J. C. Nelson 4512* (WI); 5 mi. n. of Corvallis, June 27, 1916, *Gilbert 474* (O); Corvallis, July 29, 1926, *Scullen* (O).

37a. f. *dentata* Steyermark, f. nov.⁵⁰

Stems glabrous to sparsely villous above, mostly non-glandular; upper and middle cauline leaves coarsely dentate, those on floriferous branchlets dentate to subentire, membranaceous to firmly membranaceous or subcoriaceous; involucre with filiform-subulate spreading or ascending tips.

⁵⁰ *G. integrifolia* f. *dentata* Steyermark, f. nov., caulibus glabris vel supra parce villosis, plerumque non glandulosis; foliis caulinis superioribus et mediis grosse dentatis.—Collected on waste ground, Salem, Oregon, July 14, 1917, *J. C. Nelson 1670* (Gray Herb. TYPE).

Distribution: gravelly stream beds along railroads and waste ground in the vicinity of Salem, Albany, and Eugene, Oregon.

OREGON: along railroad, Salem, July 30, 1917, *J. C. Nelson 1796* (G); gravelly stream bed on S. 12th St., Salem, June 24, 1921, *J. C. Nelson 3912* (G, PA); waste ground, Salem, July 14, 1917, *J. C. Nelson 1670* (G TYPE); Albany, Linn Co., July 11, 1894, *Lloyd* (NY); dry ground south of Salem, Marion Co., July 19, 1928, *Thompson 5103* (M); moist ground, Salem, July, 1911, *Peck 4918* (WI).

37b. var. *virgata* (Nutt.) Torr. & Gray, Fl. N. Am. **2**: 248. 1842.

G. virgata Nutt. Trans. Am. Phil. Soc. N. S. **7**: 314. 1841; Torr. & Gray, Fl. N. Am. **2**: 248. 1842, as synonym; Walp. Rep. Bot. Syst. **2**: 585. 1843; Gray, Syn. Fl. N. Am. **1**²: 117. 1884, and ed. 2. 117. 1888, as synonym; Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 557. 1906, as synonym.

G. integrifolia DC. acc. to Gray, Syn. Fl. N. Am. **1**²: 117. 1884, and ed. 2. 117. 1888, in part; acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 557. 1906.

G. nana Nutt. acc. to Gray, Syn. Fl. N. Am. **1**²: 119. 1884, and ed. 2. 119. 1888, in part; acc. to Howell, Fl. N. W. Am. 296. 1900, in part; acc. to Piper & Beattie, Fl. N. W. Coast. 362. 1915, in major part.

Stems slender, dull reddish-brown or purplish-red to stramineous, glabrous to minutely glandular-puberulent, mostly 5.5–10.5 dm. tall; upper leaves entire to denticulate, middle and upper leaves 1.5–7 cm. long, 0.25–1.5 cm. broad, 5–10 times longer than broad, the upper linear-oblong or lanceolate-linear, acute to acuminate, subamplexicaul, the middle linear-ob lanceolate to oblong-ob lanceolate and subamplexicaul, acute, glabrous to sparsely glandular-puberulent; disk 0.8–1.2 cm. high, 0.9–1.7 cm. broad; involucre slightly to conspicuously resinous, glabrous to minutely glandular.

Distribution: fields and rocky slopes, local in vicinity of Vancouver, also on San Juan Islands, Washington, and south in the Willamette River Valley to Douglas Co., Oregon.

WASHINGTON: Vancouver, Sept., 1902, *Piper 3805* (US); F. V. (probably Fort Vancouver), *Tolmie* (G); dry rocky slope, 3½ miles from Friday Harbor, San Juan Islands, July 7, 1923, *Peck 12920* (ST).

OREGON: Eugene City, Sept. 1, 1889, *Greene* (N, NY); Salem, July 22, 1920, *Clemens* (CAS); Salem, *Johnson 518* (G, UW); Oregon, *Hooker* (G); North Yamhill, July 8, 1882, *T. Howell* (F, M, NY); rocky islands of the Willamette, and

fields, Yamhill Co., also near Portland, July 8, 1882, and Sept. 12, 1888, *Henderson 434* in part (M, NY, O); gravelly plains, Salem, July, 1887, *Gorman* (UW); Columbia woods, *Nuttall* (PA isotype, PO photograph of isotype, B photograph of TYPE); Willamette River above Portland, July, 1878, *T. Howell* (US); Multnomah Co., June, 1877, *T. Howell* (US); abundant in dry ditches along road, Sutherlin, Douglas Co., Aug. 31, 1927, *Blake 10385* (B); Albany, July 20, 1924, *H. M. Hall 11996* (ST); Sutherlin, Douglas Co., June 19, 1916, *Peck 4916* (WI); damp open ground, Salem, June 14, 1909, *Peck 4904* (WI); dry soil by roadside, 1 mi. n. of Salem, Aug. 12, 1922, *J. C. Nelson 4618* (O).

37c. var. *virgata* f. *villosa* Steyermark, f. nov.⁵¹

Stems more or less villous with crooked weak hairs, more densely villous towards heads; leaves sparsely villous-puberulent on margins and puberulent on surfaces, somewhat resinous-punctate.

Distribution: Willamette Valley, Oregon.

OREGON: 1871, *E. Hall 266* (F, G, M TYPE, NY, US); fields in fir woods, Yamhill Co., July 8, 1882, *Henderson 432* in part (O).

This species has been confused with *G. stricta*, *G. oregana*, and *G. virgata* (*G. integrifolia* var. *virgata*), many botanists having interpreted it as the coastal plant of Washington, Oregon, and British Columbia. It is, however, an inland species, strictly limited to the Willamette Valley of Oregon. I have before me a photograph and fragment of the type of *G. integrifolia* DC. which is beautifully matched by villous-stemmed material collected in the Willamette Valley. De Candolle described his plant from a specimen cultivated at the Horticultural Society of London, seeds of which had been sent from western North America, undoubtedly collected and sent over by Douglas. On page 214 of Douglas's 'Journal' we read, "Picked up a species of *Donia* in flower and seed and a small annual plant closely allied to *Phlox*, both on rich light dry loam in open woods." At this time Douglas was encamped in an oak-pine belt on the south side of the Yamhill River, Oregon, and the night previously he had camped on the Multnomah River. The collection cited by Hooker "near the sources of

⁵¹ *Grindelia integrifolia* var. *virgata* f. *villosa* Steyermark, f. nov., caulibus villosiusculis; foliis ad margines parce villosopuberulis aliter puberulis.—Collected in Oregon, 1871, *E. Hall 266* (Mo. Bot. Gard. Herb. no. 130132 TYPE, F, G, NY, US, isotypes).

the Multnomah River," under *Donia inuloides* β in 'Flora Boreali Americana' 2: 25. 1834, is probably the one which Douglas had made at the localities cited in his journal, and is *G. integrifolia*. In Sweet's 'Hortus Britannicus' ed. 2. p. 299. 1830, and again in ed. 3. p. 346. 1839, there appears in the list of plants cultivated a *Grindelia* named "*G[rindelia] villosa* Dougl."; opposite the botanical names are the English names, apparently translations, since "villous" appears to the right of *Grindelia villosa* Dougl. This is undoubtedly the *Donia* which was referred to as *Donia villosa* Hort. ex Hook. 'Comp. Bot. Mag.' 2: 141. 1836, and which Douglas on p. 214 of his journal referred to as *Donia*. A specimen of *G. integrifolia* in the Gray Herbarium cited as such in the 'Synoptical Flora of North America' is labelled "*Grindelia villosa*" from J. Gay's herbarium, and is a plant which was cultivated at the Jardin des Plantes in 1835, according to data on this label; this specimen is typical *G. integrifolia* and probably represents plants cultivated from seeds of the same collection as De Candolle's type specimen.

While Douglas's name, *G. villosa* Dougl. ex. Sweet, antedates *G. integrifolia*, and though there is no doubt that the seeds collected by Douglas from the Multnomah River region and grown in Europe and England represent the plant which De Candolle described as *G. integrifolia*, yet *G. villosa* Dougl. ex. Sweet remains as a *nomen nudum*. Although it may be contended that the English word "villous" was used after *G. villosa* in Sweet's 'Hort. Brit.' ed. 2 and 3, and that this adjective was sufficiently expressive to characterize and identify the species now passing as *G. integrifolia*, the fact remains that this use of the term "villous" was not a description, but only an English translation of the Latin. A similar case is Muhlenberg's 'Catalogue' where specific epithets are likewise translated, and since Muhlenberg's names are now universally regarded as *nomina nuda* or *subnuda*, the same must hold for the translatory use of names in Sweet's 'Hortus Britannicus.'

Through an examination of many specimens from the Willamette Valley region such a considerable amount of intergrad-

ation has been found between *G. integrifolia* and *G. virgata* that the latter cannot be accepted as a distinct species, but must be regarded, instead, as a variety.

Grindelia integrifolia var. *virgata* and f. *dentata* have been confused with *G. nana* and varieties. The position of the involueral bracts is quite distinctive, however, for in *G. nana* and varieties the tips of the bracts are strongly recurved or revolute, whereas in *G. integrifolia* and varieties they are erect, ascending, or spreading-ascending.

38. *G. columbiana* (Piper) Rydb. in Bull. Torr. Bot. Club **37**: 128. 1910, without description; Fl. Rocky Mts. 849. 1917.

G. discoidea Nutt. Trans. Am. Phil. Soc. N. S. **7**: 315. 1841, not *G. discoidea* Hook. & Arn.; Walp. Rep. Bot. Syst. **2**: 586. 1843; Gray in Geol. Surv. Cal. Bot. **1**: 304. 1876; Howell, Fl. N. W. Am. 296. 1900.

G. nana Nutt. var. *discoidea* (Nutt.) Gray, Syn. Fl. N. Am. **1**²: 119. 1884, and ed. 2. 119. 1888; Henry, Fl. S. Brit. Col. 291. 1915, as to name only.

G. nana columbiana Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 556. 1906, as nom. nov. without description; Piper & Beattie, Fl. N. W. Coast. 362. 1915.

Stems fastigiately or corymbosely branched above, the slender floriferous branchlets strongly ascending and usually elongated, stramineous to purplish-red, glabrous, 2.5–8 dm. tall; leaves firmly membranaceous, dull olive- or pale-green, abundantly and conspicuously punctate, entire to remotely but regularly denticulate with short projections or coarsely or incised-dentate, main middle and upper cauline 2.5–10 cm. long, 0.3–1.5 cm. broad, 5–11 times longer than broad, lower and middle linear-oblong to broadly oblanceolate, upper oblong to lanceolate, acute, glabrous; heads discoid; disk mostly depressed-hemispherical, the receptacle slightly distending at the base, 0.7–1.1 cm. high, 0.9–2.0 cm. broad; involucre conspicuously and abundantly resinous, bracts 2–9 mm. long, terete and thickened, the outer and middle linear to narrowly lanceolate with subulate tips 1–2.5 mm. long, the upper third to fifth of the bracts strongly reflexed or revolute, glabrous; receptacle con-

spicuously foveolate; achenes narrowly oblong, 3.5–5 mm. long, 1.5–1.7 mm. broad, smooth or somewhat roughened on the striations, light brown or stramineous, when mature with usually 2 rather conspicuous knobs or projections or auriculately crowned at the apex; awns 2–3, slender, serrulate or setulose-serrulate, about $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret.

Distribution: gravelly or sandy banks, shores, bluffs, or river bars usually following river courses, occasionally on sage-brush plains and along railroad tracks and roadsides, from the mouth of the Columbia River along its course in Oregon and Washington and along the Snake River in Idaho.

IDAHO: Blackfoot, Aug. 9, 1892, *Mulford* (GM, MU, NY); dried sink, near Blackfoot, July 23, 1897, *Henderson* 2996 (G).

WASHINGTON: sagebrush plains near Wilbur, Lincoln Co., June 30, 1931, *Thompson* 7164 (B, CAL, E, G, M); along railroad tracks west of Western Storage Co., near Columbia River, Wenatchee, Chelan Co., alt. 365 m., Aug. 13, 1931, *Moore & Steyermark* 3692 (M); 4 mi. east of Cle Elum, Kittitas Co., alt. 1000 m., Aug. 13, 1931, *Moore & Steyermark* 3694 (M); sandy banks of the Columbia River, W. Klickitat Co., Sept., 1883, *Suksdorf* 189 (CAL, F, G, US); Grand Coulee, above Blue Lake, Grant Co., July 5, 1926, *Babcock & Collins* 52 (CAL); Kennewick, Benton Co., Aug., 1926, *G. N. Jones* 354 (PA); Meyers Falls, Aug. 21, 1902, *Kreager* 473 (G, MU, NY, US); Wilson Creek, Whitman Co., Aug. 6, 1892, *Lake & Hull* 753 in part (UW); sandy banks of Columbia River, Bingen, W. Klickitat Co., Aug. 27, 1903, *Suksdorf* 515 (ST).

OREGON: Dalles, June 10, 1868–9, *Kellogg & Harford* 406 (G, US); slopes overlooking the Columbia River at the Dalles, Wasco Co., July 4, 1931, *J. T. Howell* 7194 (CAS); Dalles, June 10, 1869, *Harford & Dunn* (NY); 1871, *E. Hall* 268 (F, G); muddy shore of Columbia River on Hayden Island, opposite Vancouver, Washington, Oct. 9, 1920, *J. C. Nelson* 3394 (G); Oregon plains, *Nuttall* (G); Vancouver, *Nuttall* (PA isotype of *G. discoidea* Nutt.); dry rocky bluffs, Shell Rock, Columbia River, Aug. 21, 1882, *Henderson* 435 (M, O); Lower Albina, Portland, Aug. 12, 1902, *Sheldon* s. 10960 (F, G, M, MU, NY, PO, US).

From *G. nana* this species differs chiefly in its more serrulate or setulose-serrulate pappus awns, discoid heads, and in a receptacle which becomes slightly distended at the base.

39. *G. stricta* DC. Prodr. 7: 278. 1838; Torr. & Gray, Fl. N. Am. 2: 248. 1842; Gray in Geol. Surv. Cal. Bot. 1: 304. 1876, as synonym; Macoun, Cat. Can. Pl. pt. 2. 209. 1884; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as synonym of *G. integrifolia*; Henry, Fl. S. Brit. Col. 291. 1915; Piper & Beattie, Fl. N. W. Coast. 363. 1915, as probable synonym.

Donia glutinosa Hook. Fl. Bor. Am. 2: 25. [1834] 1840, in part, as to plant of *Scouler* in N. Y. Bot. Gard. Herb., and ex-

cluding synonymy, not *Donia glutinosa* R. Br.; Macoun, Cat. Can. Pl. pt. 2. 209. 1884, as synonym.

G. hirsutula Hook. & Arn. acc. to Gray in Geol. Surv. Cal. Bot. 1: 304. 1876, as to *Wilkes* plant in N. Y. Bot. Gard. Herb.

G. integrifolia DC. acc. to Torr. & Gray, Fl. N. Am. 2: 248. 1842, as to plant of *Scouler*; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in large part, excluding range in British Columbia and synonymy as to *G. stricta* and *G. virgata*; Macoun, Cat. Can. Pl. pt. 2. 209. 1884, excluding plant of *Macoun*; Henry, Fl. S. Brit. Col. 291. (a). 1915, excluding *G. macrophylla*.

G. oregana Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, in small part, at least as to plant of *Hall 265*; Howell, Fl. N. W. Am. 296. 1900, in part, excluding habitat and range in Idaho; Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906, in large part, as to plants of *Conard 387* and *Lamb 1270*; Piper & Beattie, Fl. N. W. Coast. 363. 1915.

G. oregana Gray subsp. *Wilkesiana* Piper in Piper & Beattie, Fl. N. W. Coast. 363. 1915, as to plant of *Osgood*.

G. oregana Gray f. *Wilkesiana* (Piper) St. John & R. Sprague in Proc. Biol. Soc. Wash. 41: 199. 1928.

Herbaceous to suffrutescent perennial, mostly with basal tufts of leaves; stems erect or ascending, usually decumbent at the base, slender, stramineous or greenish to rose-purple, unbranched to sparsely branched above with few or several slender floriferous branchlets bearing one or few heads, glabrous to loosely villous below the heads, 2–6 dm. tall; leaves rather few, scattered, fleshy, pale green, resinous-punctate, entire to denticulate or serrulate, the main cauline 5–13 cm. long, 0.7–2 cm. broad, 5–8 times longer than broad, narrowly oblanceolate to oblong-spatulate, acute to obtuse, narrowed below the middle to a slender subamplexicaul base, the upper leaves oblong to lanceolate-oblong, acute to obtuse, scarcely narrowed below the middle; disk depressed to campanulate-hemispherical, 1.1–1.5 cm. high, 1.6–2.5 cm. broad; involucre moderately or slightly resinous, 4–5-seriate, bracts linear to lanceolate with long subulate tips, 5–12.5 mm. long, rather thin and submem-

branaceous, the upper third to half of the bracts free and spreading, reflexed to incurved at the tips, glabrous to lightly villosulous; rays 22–35, conspicuously elongated, bright yellow to orange-yellow, the lamina 14–19 mm. long; achenes oblong, 3.5–5 mm. long, 1.5–2 mm. broad, stramineous to light brown, smooth or slightly roughened at the angles, the truncate or oblique apex slightly bordered at the angles with shallow low processes; awns 2–5 to the floret, remotely to numerously setulose-serrulate, 3–5.5 mm. long, mostly $\frac{1}{2}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: along the Pacific Coast in wet meadows and swampy coastal ground, sands, among driftwood, lagoons at the mouths of rivers by the coast and salt marshes along sloughs and canals, Port Mulgrave and Kasaan, southern Alaska, Queen Charlotte Islands, western coast of Vancouver Island, south to Mendocino Co., California.

WASHINGTON: on sands among "driftwood," Toke Point, Pacific Co., July 27, 1908, *Foster 831* (US); tufts along shore, Port Discovery, Jefferson Co., Sept. 13, 1921, *St. John 5860* (B); Oyhut, Chehalis Co., July 8, 1891, *Lamb 1270* (F, M, NY); wet meadows beside stream, Copalis, June and July 23, 1902, *Conard 387* (G, MU, NY); shores of Puget Sound near Steilacoom, Pierce Co., Aug. 22, 1933, *Thompson 9959* (M).

OREGON: Waldport, Lincoln Co., July 25, 1924, *Peck 13503* (B, WI); salt marsh north of Coos Bay, Coos Co., July 18, 1929, *Henderson 11420* (CAL); salt marshes, Tillamook Bay, July 15, 1882, *T. Howell* (F, NY); on shores of lagoon at mouth of Siuslaw River, Sept. 7, 1911, *Gorman X* (PA); North Bend, 5 mi. north, along highway, border of marsh, July 18, 1926, *Scullen 113* (O); salt marsh, bridge north of Coos Bay, Coos Co., July 18, 1929, *Henderson 11420* (UO); tidewater bog near Hauser, Coos Co., Aug. 22, 1929, *Henderson 11454* (UO); Marshfield, July, 1917, *Eschen* (WI); salt flat near Garibaldi, Tillamook Co., July 8, 1924, *Peck 13359* (WI).

CALIFORNIA: Crescent City, Del Norte Co., June 30, 1899, *Davy & Blasdale 5957* (CAL); sea bluffs beyond Westport, Mendocino Co., June, 1927, *Sutcliffe* (CAS); Big Lagoon, Humboldt Co., Aug. 30, 1925, *Tracy 7255* (CAL); Big Lagoon, Humboldt Co., Aug. 22, 1927, *Wolf 783* (ST); Big Lagoon, June 25, 1926, *Kildale 2172* (ST); dry bluff, Dyerville, July 10, 1925, *Kildale 944* (ST).

ALASKA: Kasaan Mountain, July 16, 1902, *Newcombe* (US); *Haenke* (CAL fragment and photograph of TYPE, G, US photograph of TYPE).

CANADA: BRITISH COLUMBIA—sand spit, Crescent, Sept. 1, 1914, *Henry* (CAS); on the beach, Long Arm, Skidigate, Queen Charlotte Islands, July 26, 1897, *Newcombe* (CAN); Nootka Sound, *Scouler* (NY); Alberni, July, 1916, *Carter* (G); salt marsh near Alberni, Vancouver Island, June 27, 1916, *Henry 9049* (G).

39a. f. venulosa (Jepson) Steyermark, comb. nov.

G. venulosa Jepson, Man. Fl. Pl. Cal. 1021. 1925.

G. glutinosa (Cav.) Dunal acc. to Gray, Syn. Fl. N. Am. 1²:

119. 1884, and ed 2. 119. 1888, as to plant of *Bolander* 6493 only.

G. oregana Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to plant of *Hall* "cult. e. sem. Yaquina Bay, Oregon."

Stems erect or ascending, glabrous or infrequently villous; main cauline leaves sparsely to rather regularly dentate, especially in upper half, with short broad acute teeth, 4.5–9 cm. long, 1.5–3 cm. broad, 2½–4 times longer than broad, obovate-oblong, obtuse, gradually narrowed to a subamplexicaul base.

Distribution: sands along seashore and coastal lagoons, Tillamook and Lincoln Counties, Oregon south to Humboldt Co., California, and locally south to Marin Co., California.

OREGON: Garibaldi, Tillamook Co., Aug. 25, 1894, *Lloyd* (NY); "cult. e. sem.," Yaquina Bay, *Hall* (G, M, US).

CALIFORNIA: in quicksand on sea-shore near Big Flat, Humboldt Co., 1867, *Bolander* 6493 (J TYPE, US); Shelter Cove, Humboldt Co., June 25, 1927, *Kildale* 3554 (ST); Point Reyes, Marin Co., July, 1903, *Elmer* 4621 (CAL, M, MU, NY, US).

39b. var. procumbens Steyermark, var. nov.⁵²

Stems procumbent, subcaespitose 1.5–3.5 dm. tall; radical leaves shorter than the species, 4.5–9 cm. long.

Distribution: sandy seashores along coast, Humboldt Co., California.

CALIFORNIA: sandy shores, Big Lagoon, Humboldt Co., alt. 20 ft., July 10, 1921, *Tracy* 5856 (PO); north shore of Big Lagoon, Humboldt Co., Sept. 14, 1930, *H. E. & S. T. Parks* 0773 (CAL); on sandy seashore at base of cliffs, 10 miles north of Trinidad, Humboldt Co., alt. 1 m., Aug. 9, 1931, *Moore & Steyermark* 3687 as to second sheet (M TYPE).

39c. var. Andersonii (Piper) Steyermark, comb. nov.

G. Andersonii Piper in Proc. Biol. Soc. Wash. 31: 77. 1918.

Stems loosely villous near the heads; leaves numerous, crowded and conspicuously elongated on the floriferous branchlets immediately beneath the heads, the middle and upper cauline 5.5–9 cm. long, 4–7 mm. broad, mostly 10–15 times longer than broad, linear- to narrowly oblanceolate-spatulate, acute, narrowed to a subamplexicaul base.

⁵² *G. stricta* var. *procumbens* Steyermark, var. nov., caulibus procumbentibus, subcaespitosis, 1.5–3.5 dm. altis; foliis radicalibus brevioribus quam apud speciem, 4.5–9 cm. longis.—Collected on sandy seashore at base of cliffs, 10 miles north of Trinidad, Humboldt Co., California, alt. 1 m., Aug. 9, 1931, *Moore & Steyermark* 3687 second sheet (Mo. Bot. Gard. Herb. no. 1025979 TYPE).

Distribution: tidal flats at Saanich Arm, Vancouver Island, British Columbia.

BRITISH COLUMBIA: Saanich Arm, Vancouver Island, July 5, 1917, *Anderson* (US photograph and fragment of TYPE).

39d. var. *aestuarina* Steyermark, var. nov.⁵³

G. hirsutula Hook. & Arn. acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 1²: 117. 1888, in part, as to plant of Lyall from Saturna Island.

G. integrifolia DC. acc. to Macoun, Cat. Can. Pl. pt. 3. 542. 1886.

G. oregana Gray acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, in part, as to plant of *Douglas* in Gray Herb.; acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906, as to plants of *Binns*, and *Piper* 2865.

Stems glabrous, subcorymbosely to corymbosely branched above with several to many heads; leaves more firmly membranaceous, more conspicuously resinous-punctate, the main cauline subentire to remotely to moderately denticulate or serrulate with short acute teeth, sometimes only the apical region toothed, or sharply and closely serrate or dentate; involucre more conspicuously and abundantly resinous.

Distribution: salt marshes, sand spits, and beaches in the Puget Sound region, Washington, and north on the east coast of Vancouver Island, British Columbia.

UNITED STATES: WASHINGTON—tide-lands, Marysville, June, 1928, *Grant* (R TYPE); Vashon Island, Puget Sound, Sept. 12, 1909, *Moyer* (MU); Seattle, July, 1915, *Freiberg* (M); along beach, Port Ludlow, Sept. 5, 1890, *Binns* (G); salt marsh near West Point Lighthouse, Seattle, Oct. 11, 1911, *Havens* (UW).

CANADA: BRITISH COLUMBIA—Saturna Island, 1858, *Lyall* (G); sand spit at mouth of Campbell River, Vancouver Island, *J. T. Howell* 7579 (CAS).

39e. var. *aestuarina* f. *elongata* Steyermark, f. nov.⁵⁴

Stems glabrous, 5–9 dm. tall, much-branched above with elongated closely ascending foliose floriferous branchlets 1–

⁵³ *G. stricta* var. *aestuarina* Steyermark, var. nov., caulibus erectis vel ascendentibus, irregulariter subcorymboso- vel corymboso-ramosis; foliis firme membranaceis, valde resinosis, caulinis principalibus subintegris vel remote vel moderatim denticulatis vel serrulatis cum dentibus brevibus tenuibus acutis vel salienter serratis vel dentatis; involucre valde et abundanter resinoso.—Collected in tide-lands, Marysville, Washington, June, 1928, *J. M. Grant* (Rocky Mountain Herb. TYPE).

⁵⁴ *G. stricta* var. *aestuarina* f. *elongata* Steyermark, f. nov., caulibus glabris, 5–9 dm. altis, supra valde ramosis, ramusculis floriferis elongatis saepius ascendentibus; foliis firme membranaceis vel subcoriaceis, caulinis superioribus et illis in ramusculis floriferis remote denticulatis cum dentibus brevibus tenuibus

3 dm. long, bearing several to many heads; leaves firmly membranaceous, remotely to closely serrate or denticulate with short fine teeth, or more saliently serrate or dentate sometimes only about the base, the upper cauline and those on floriferous branchlets lanceolate to ovate-lanceolate, acute to acuminate, subamplexicaul to amplexicaul, glabrous except for the sparsely scabridulous margins; disk 0.9–1.5 cm. high, 1.6–2.5 cm. broad; involucre moderately resinous, outermost bracts merging gradually into the more reduced leaves immediately surrounding the heads, linear to lanceolate with conspicuously elongated attenuate subulate tips 7–16 mm. long, glabrate to pilosulous.

Distribution: along estuaries and tidal ground, vicinity of Victoria, Vancouver Island, British Columbia, and near Seattle, Washington.

UNITED STATES: WASHINGTON—East Sound, San Juan Islands, June 25–Aug. 1, 1917, *S. M. & E. B. Zeller* 955 (G, M, MU, NY).

CANADA: BRITISH COLUMBIA—margin of arm of Victoria Harbor, 3 miles from Victoria on Island Highway, Vancouver Island, July 27, 1931, *J. T. Howell* 7545 (CAS TYPE, M isotype).

39f. var. *macrophylla* (Greene) Steyermark, comb. nov.

G. macrophylla Greene, Pitt. **3**: 297. 1898; Henry, Fl. S. Brit. Col. 291. 1915, as synonym.

G. integrifolia DC. acc. to Gray, Syn. Fl. N. Am. **1**²: 117. 1884, and ed. 2. 117. 1888, in part, as to plant of *Suckley* from Fort Steilacoom, Puget Sound; Henry, Fl. S. Brit. Col. 291. (a). 1915, in part.

G. oregana Gray acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] **11**: 557. 1906, in part, as to plant of *Suckley* from Fort Steilacoom.

Stems stout, glabrous below, lightly to densely villous or glandular-villous near the heads, strongly corymbosely branched above with stout elongated strongly ascending foliose floriferous branchlets 1–3 dm. long, bearing several to numerous heads, 0.5–1 m. tall; leaves thin and membranaceous, pale

acutis vel acuminatis vel salientioribus basi modo vel serratis cum dentibus salientibus, lanceolatis vel ovato-lanceolatis; bracteis extremis involucri valde elongatis, foliaceis.—Collected on margin of arm of Victoria Harbor, 3 miles from Victoria on Island Highway, Vancouver Island, British Columbia, July 27, 1931, *J. T. Howell* 7545 (Cal. Acad. Sci. Herb. no. 188502 TYPE, M, isotype).

green, scarcely resinous-punctate, entire to remotely coarsely dentate, the middle and upper cauline 2–11 cm. long, 0.5–2.5 cm. broad, broadly oblong-lanceolate or oblong to ovate-lanceolate or pandurate-oblong, acute, subamplexicaul to amplexicaul, the radical 2–4 dm. long, 1.5–4.5 cm. broad, glabrous; disk 1.2–1.6 cm. high, 1.9–3 cm. broad; involucre scarcely resinous, bracts 1–2 cm. long, the outer and middle loosely spreading or ascending with filiform-subulate or linear to linear-lanceolate tips 5–10 mm. long; rays 25–35, conspicuous, the lamina 15–20 mm. long; achenes 5–7.5 mm. long; awns mostly moderately to numerous setulose to serrulate.

Distribution: salt marshes along estuaries, Vancouver and vicinity, British Columbia, south locally in Puget Sound region, about Seattle and Steilacoom, Washington.

UNITED STATES: WASHINGTON—Point Orchard, July, 1889, *Piper* (UW); abundant in marine marshes, Seattle, July, 1892, *Piper* (G, NY, UW); Fort Steilacoom, Puget Sound, *Suckley* (G, NY, US).

CANADA: BRITISH COLUMBIA—wet ground, salt marsh, Crescent, Sept. 10, 1914, *Henry* (NY); salt marsh, Vancouver, Oct. 9, 1914, *Henry* (CAS); tide-water swamp near Vancouver, July, 1890, *Greene* (N TYPE).

39g. var. *Hendersoni* (Greene) Steyermark, comb. nov.

G. Hendersoni Greene, Pitt. 2: 18. 1889; Howell, Fl. N. W. Am. 295. 1900; Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906; Piper & Beattie, Fl. N. W. Coast. 363. 1915, as synonym.

G. integrifolia DC. acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in part, as to plant of *Lyall* from Fidalgo Island.

G. oregana Gray acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906, as to plant of *Lyall* from Fidalgo Island.

Suffrutescent perennial with tufts of leaves arising from branching ligneous stems, the herbaceous shoots of the season from branching aerial elongated ligneous stems up to 2.5 dm. long, the herbaceous shoots 2.5–3.6 dm. tall, loosely to densely villous or lanulose, mostly simple throughout and bearing one or few heads on unbranched or sparsely branched foliose branchlets; leaves entire to closely or rather remotely dentate or serrate with short broad teeth, the main cauline 5.5–7 cm. long, 1–1.5 cm. broad, the middle and upper cauline oblong, ob-

tuse, submucronate, subamplexicaul, lightly hirsutulous or somewhat closely villosulous to glabrate; involucral bracts villosulous to glabrous, the outer more pubescent.

Distribution: rocky shores on Lummi and Fidalgo Island, Puget Sound, Washington, north to British Columbia.

UNITED STATES: WASHINGTON—Fidalgo Island, 1858, *Lyall* (G); rocky banks, Bellingham Bay and Gulf of Georgia, *Henderson* 1676 in part (F, G, N TYPE); Whidby Island, July, 1896, *Gardner* (CAL).

CANADA: BRITISH COLUMBIA—Oak Bay, Vancouver Island, June 17, 1902, *Diehl* 150 (PO); sand hills, Pt. Holmes, near Comox, July 1, 1893, *Macoun* (CAN).

39h. var. *lanata* (Greene) Steyermark, comb. nov.

G. lanata Greene, Pitt. 2: 290. 1892; Henry, Fl. S. Brit. Col. 290. 1915.

G. hirsutula Hook. & Arn. acc. to Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, in part, as to plant of *Holmes* from Fraser River; acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as to plant of *Holmes* from Fraser River.

G. integrifolia DC. acc. to Macoun, Cat. Can. Pl. pt. 2. 209. 1884, in part, as to plants of *Macoun*.

G. oregana Gray acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906, as to plant of *Henderson* 2300 on left side of sheet.

G. oregana subsp. *Wilkesiana* Piper in Piper & Beattie, Fl. N. W. Coast. 363. 1915, in part, as to plants from Nisqually, *Wilkes Exped.*, and Fraser River, *Holmes*.

G. integrifolia DC. var. *aestivalis* Henry, Fl. S. Brit. Col. 291. 1915, in part.

Herbaceous stems of the season arising directly or almost directly from the main caudex, 4–7 dm. tall, corymbosely to subcorymbosely branched above with several rather elongated branchlets bearing several heads, lightly to densely villous or lanulose, especially in the upper portions; leaves entire to serrate, the middle and upper cauline (including those on floriferous branchlets) 1.5–9 cm. long, 0.5–3.5 cm. broad, oblong or oblong-ob lanceolate to pandurate-oblong or ovate-lanceolate, subamplexicaul to amplexicaul, slightly to moderately villous or glabrate and villosulous only on margins; involucral bracts sparsely to densely villosulous or lanulose to glabrate, the outer bracts mostly pubescent.

Distribution: rocky or open places near seashore, or sometimes escaped along roadsides, near Vancouver, British Columbia, southern and eastern Vancouver Island and scattered in the Puget Sound region, Washington.

UNITED STATES: WASHINGTON—Gulf of Georgia, Lummi Island, 1888, *Henderson* 1676 in part (G); roadside near station, Friday Harbor, San Juan Islands, July 27, 1923, *Peck* 13138 (M); along shore, Oak Park, Victoria, June 23, 1920, *Eastwood* 9727 (CAS); Nisqually, *Wilkes* 22 (US).

CANADA: BRITISH COLUMBIA—Fraser River, *Holmes* (G, NY, US); on rocks by the sea, Oak Bay, Vancouver Island, June 18, 1887, *Macoun* (CAN, N TYPE); Kitsilano, Vancouver City, Aug. 21, 1911, *Malte* (CAN, US); Vancouver Island, June 18, 1902, *M. E. Jones* (PO); near shore, Oak Bay, Victoria, July 26, 1913, *Henry* (NY).

39i. var. *collina* (Henry) Steyermark, comb. nov.

G. collina Henry, Fl. S. Brit. Col. 291. 1915.

G. oregana Gray acc. to Piper in Contr. U. S. Nat. Herb. [Fl. Wash.] 11: 557. 1906, as to plant of *Henderson* 2300 on right side of sheet.

G. integrifolia DC. var. *aestivalis* Henry, Fl. S. Brit. Col. 291. 1915, in part.

G. nana var. *discoidea* (Nutt.) Gray acc. to Henry, Fl. S. Brit. Col. 291. 1915.

Stems slender, mostly corymbosely branched above with slender ascending floriferous branchlets bearing several heads, glabrous or villous below, sparsely to moderately villous above, 2.5–7 dm. tall; leaves firmly membranaceous, slightly to moderately resinous-punctate, the main cauline remotely denticulate or serrulate to sharply serrate, the upper cauline entire to subentire, the middle and upper cauline (including those on floriferous branchlets) 2–7 cm. long, 0.2–1.2 cm. broad, narrowly oblong-lanceolate or linear-oblong to oblanceolate-spatulate, glabrous to villosulous; disk 0.8–1 cm. high, 1.1–2 cm. broad; involucre moderately to rather abundantly resinous, the bracts with slender filiform to subulate tips 2–6 mm. long, mostly glabrate or sparsely villosulous; lamina of rays 10–14 mm. long; achenes 3–4 mm. long, 1.5–1.8 mm. broad.

Distribution: dry or rocky hillsides, about lakes slightly inland or sea-cliffs or rocky banks near sea-shore, southern Vancouver Island, and in the Puget Sound region, Washington.

UNITED STATES: WASHINGTON—Goose Rock, Coupeville, July, 1923, *Grant* (UW); dry bluffs, July, 1922, *Grant* (G); Friday Harbor, San Juan Islands, June 25–Aug. 1, 1917, *S. M. & E. B. Zeller* 954 (G, M, MU, NY).

CANADA: BRITISH COLUMBIA—on a dry open hillside (inland), Thetis Lake, Vancouver Island, June 13, 1919, *Carter* (G); rocky hillside overlooking sea, Victoria, July 21, 1912, *Henry* (CAS); dry hill, Thetis Lake (near Victoria), Vancouver Island, July 18, 1915, *Henry* (NY TYPE).

The identity of this species has puzzled previous authors. A careful examination of a fragment and photograph of the type shows that this is the coastal species ranging from Alaska to California, which has passed, together with its varieties and forms, as *G. hirsutula* in part, *G. integrifolia* in part, *G. ore-*



Fig. 32. *G. stricta*. $\times \frac{1}{5}$.



Fig. 33. *G. aggregata*. $\times \frac{1}{5}$.

gana in part, and *G. glutinosa*. The locality where Haenke collected *G. stricta* was cited by De Candolle as Port Mulgrave, and although a number of Haenke's localities have been mixed in data or have proved obscure or erroneous, it is to be noted that in the case of *G. stricta* it is probably correct. Notwithstanding the fact that there are several "Port Mulgraves" and "Mulgraves" scattered throughout the world, there is a Port Mulgrave on Yakutat Bay, Alaska, in lat. $59^{\circ} 34' N$. This was an Indian Village and Moravian Mission station, and Haenke's expedition undoubtedly stopped here since Yakutat

Bay is a well-known port in Alaska. The evidence for the occurrence of *G. stricta* this far north along the Pacific coast is strengthened by the fact that I have before me a specimen of *G. stricta* from Alaska collected by Newcombe around the region of Kasaan Mountain in Alaska (deposited in the U. S. Nat. Herb.). Other collections from Queen Charlotte Islands and Nootka Sound, British Columbia, link the Alaska stations with those farther south.

This species is quite variable in leaf shape and size, and in pubescence, and the many entities described as species are best treated as varieties and forms under the historical species, *G. stricta*.

40. *G. aggregata* Steyermark, sp. nov.⁵⁵

Stems stout, subracemosely branched with short ascending foliose contracted floriferous branchlets bearing agglomerate heads, or the whole forming a compactly arranged cluster, uniformly leafy throughout, buff or stramineous to rose-purplish, mostly glabrous, 4–6 dm. tall; leaves rather firm and fleshy or subcoriaceous, pale or dull green, scarcely resinous-punctate, closely and coarsely serrate or dentate, or sometimes the upper closely serrulate, the middle and upper cauline 4–10 cm. long, 1–3 cm. broad, 3–5 times longer than broad, the main cauline oblanceolate- to obovate-spatulate, mostly obtuse, narrowed to the base, glabrous except for sparsely villosulous margins; heads radiate, 3.5–4 cm. broad; disk campanulate-hemispherical, the sides slightly distending downward in fruit, 1–1.5 cm. high, 1.5–2.5 cm. broad; involucre mod-

⁵⁵ *G. aggregata* Steyermark, sp. nov., perennis herbacea; caulibus glabris, plerumque subracemose ramosis, ramusculis floriferis brevibus adscendentibus et contractis, capitula agglomerata ferentibus, 4–6 dm. altis; foliis plus minusve firmis et carnosius vel subcoriaceis, pallide viridibus, parce resinoso-punctatis, contiguae et grosse serratis vel dentatis, caulinis mediis et superioribus 4–10 cm. longis, 1–3 cm. latis, 3–5 plo longioribus quam latis, caulinis principalibus oblanceolato- vel obovato-spathulatis, plerumque obtusis, ad basem attenuatis; involucre moderatim vel abundanter resinoso, bracteis cum apicibus patentibus vel reflexo-squarrosis, parte libera subterete crassescente; aristis 2–4, 2.5–4.2 mm. longis, remote vel numerose serrulatis vel setuloso-serrulatis, plerumque disci flores in longitudine $\frac{1}{2}$ – $\frac{3}{4}$ aequantibus.—Collected at sea-shore, Victoria, British Columbia, Canada, Aug. 27, 1902, J. W. Congdon (Mo. Bot. Gard., Herb. no. 130104 TYPE).

erately to abundantly resinous, 4-5-seriate, 0.9-1.3 cm. high, bracts lanceolate, the upper third to half free with short spreading or reflexed-squarrose subterete thickened tips 1-4 mm. long, glabrous; receptacle conspicuously foveolate; rays 23-33, bright yellow, lamina 9-13 mm. long; achenes oblong, light brown or tawny, smooth to slightly striated about the somewhat winged angles, 2.8-3.6 mm. long, 1.3-1.7 mm. broad, truncate to slightly 2-3-auriculate at apex; awns 2-4 to the floret, stout to slender, 2.5-4.2 mm. long, mostly $\frac{1}{2}$ - $\frac{3}{4}$ length of disk-floret, remotely serrulate to numerously serrulate or setulose-serrulate.

Distribution: salt marshes and tidal flats, vicinity of Victoria, Vancouver Island, British Columbia.

BRITISH COLUMBIA: shore banks, Victoria, July 10, 1898, *Pineo* (CAL); rocks by the sea, Beacon Hill, Vancouver Island, July 4, 1887, *Macoun* (CAN, M), and Beacon Hill, Aug. 12, 1893, *Macoun* (CAN); Victoria, March 26, 1900, *Magnus* (G); Victoria, Sept. 7, 1909, *Moyer* (MU); Victoria, Aug. 23, 1908, *Nichols* (G); sea-shore, Victoria, Aug. 27, 1902, *Congdon* (M TYPE); sea-shore, Victoria, Aug., 1923, *W. A. & C. B. Setchell* (CAL).

The arrangement of the short floriferous branchlets in a compact narrow inflorescence and the firm subcoriaceous or fleshy main cauline leaves, obovate to spatulate, mark this as an entity which must be segregated as a specific unit from the *G. stricta* group.

41. *G. Blakei* Steyermark, sp. nov.⁵⁶

Suffruticose perennial with tufts of leaves on sterile or leafy shoots; stems slender, herbaceous flowering or leafy shoots of

⁵⁶ *G. Blakei* Steyermark, sp. nov., suffruticosa; caulibus herbaceis floriferis e axibus ligneis ramosis aeriis, glabris, 4.5-8 dm. altis; foliis firmis vel carnosocoriaceis, atro viridibus, minime resinoso-punctatis, integris vel remote serrulatis vel crenulato-serratis, caulinis principalibus 4-6 cm. longis, 0.7-1.4 cm. latis, 4-7 plo longioribus quam latis, lineari-oblongis vel oblongis, illis in ramusculis floriferis adversum capitula paullum reductis; capitulis 4.5-5.5 cm. latis; disco 1.2-1.5 cm. alto, 1.4-2.5 cm. lato; involuero abundanter resinoso, bracteis parte superiore liberis et valde revolutis vel valde reflexis, lineari- vel lanceolato-subulatis cum apicibus longo-filiformibus vel subulatis, 3-6 mm. longis, teretibus, coriaceis; ligulis 24-45, elongatissimis, aureo-luteis, 13-25 mm. longis, 3.5-4.2 mm. latis; achaeniis oblongis, 5-7 mm. longis; aristis 2-6, robustis, 3.8-6 mm. longis, remote vel moderatim vel numerose serrulatis, disci flores in longitudine $\frac{2}{3}$ - $\frac{3}{4}$ aequantibus.—Collected in salt meadows along canal, Eureka, Humboldt Co., California, alt. $\frac{1}{2}$ m., Aug. 9, 1931, *J. A. Moore & J. A. Steyermark* 3686 (Mo. Bot. Gard. Herb. no. 1025982 TYPE).

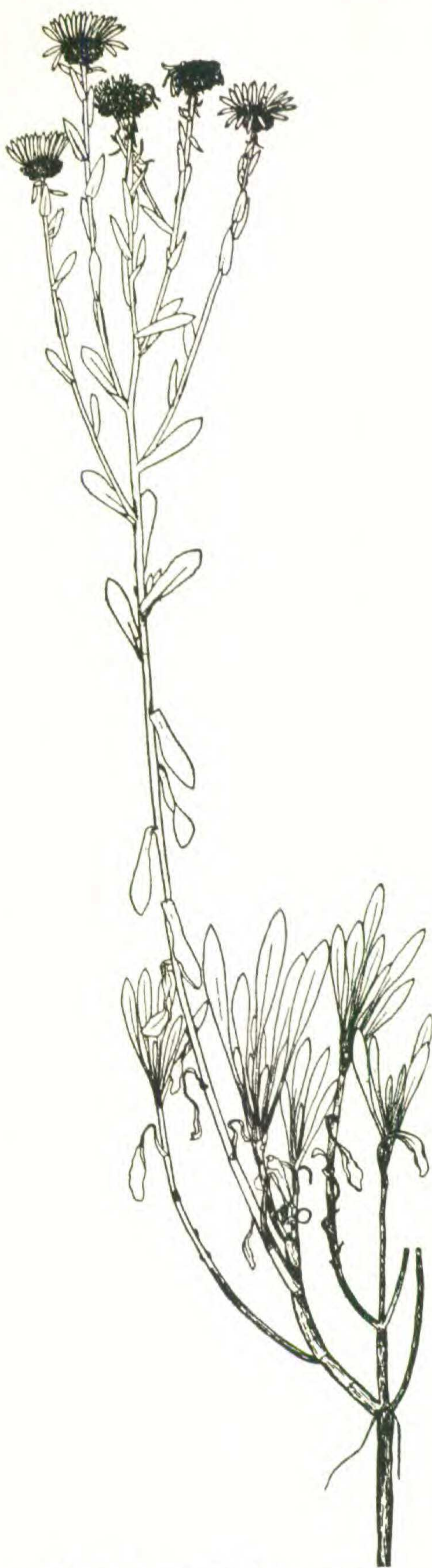


Fig. 34. *G. Blakei*. $\times \frac{1}{6}$.

the season arising from the branching aerial ligneous lower portion, corymbosely or subcorymbosely branched above the middle with few or several ascending branchlets bearing single terminal heads, chestnut- or purplish-brown, glabrous, 4.5–8 dm. tall; leaves firm or fleshy-coriaceous, dark olive-green, scarcely or apparently not at all resinous-punctate, entire to remotely serrulate or crenulate-serrate, the main cauline 4–6 cm. long, 0.7–1.4 cm. broad, 4–7 times longer than broad, linear-oblong to (the upper) oblong-lanceolate, obtuse to (the upper) acute, subamplexicaul or about as broad at base as at apex, glabrous; heads 4.5–5.5 cm. broad; disk campanulate-hemispherical, 1.2–1.5 cm. high, 1.4–2.5 cm. broad; involucre abundantly resinous, 5–6-seriate, bracts coriaceous, 5–12 mm. long, linear to lanceolate with long filiform or subulate terete and thickened tips 3–6 mm. long, glabrous, upper third to half free and strongly revolute or strongly reflexed; receptacle conspicuously foveolate; rays 24–25, conspicuously elongated, bright chrome-, cadmium-, or orange-yellow, the lamina 13–

25 mm. long, 3.5–4.2 mm. broad; achenes oblong, light chestnut-brown to buff, 5–7 mm. long, 1.6–2.3 mm. broad, striated or slightly grooved, slightly bordered at the apex with a shallow broad process, unequally developed, more prominent at one angle than at the other; awns 2–6 to the floret, stout, linear-lanceolate, 3.8–6 mm. long, remotely to moderately or numerous serrulate, $\frac{2}{3}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: salt marshes and salt-water sloughs about Humboldt Bay, Humboldt Co., California.

CALIFORNIA: common, brackish marsh, Eureka, Humboldt Co., Aug. 29, 1927, *Blake 10368* (B); common along salt-water sloughs near Samoa, Humboldt Co., alt. 0 to 500 ft., Sept. 19, 1909, *Tracy 3094* (CAL, G, US); occasional in a salt marsh at Eureka, Humboldt Co., July 21, 1924, *Heller 13870* (F, M, NY); Arcata, July 16, 1931, *M. E. Jones 29143* (CAL, M); Eureka, Sept. 26, 1921, *O'Con* (CAS); salt meadows along canal, Eureka, Humboldt Co., alt. $\frac{1}{2}$ m., Aug. 9, 1931, *Moore & Steyermark 3686* (M TYPE); marshes along highway between Eureka and Arcata, Humboldt Co., Aug. 31, 1927, *Abrams 12057* (ST); salt marsh, Eureka Bay, on the road to Arcata, Humboldt Co., Aug. 28, 1927, *Wolf 1184* (ST).

This is an endemic of the salt and brackish marshes and sloughs of Humboldt Bay, northern California, and related to the *G. humilis* and the *G. stricta* group. From the former it differs in its much shorter ligneous axis which is usually less than 3.5 dm. tall, in its longer more strongly revolute involucre bracts, longer rays, broader leaves, and fewer and larger heads; from the latter, in its leathery-coriaceous leaves, strongly revolute involucre bracts, and longer rays.

This species is named for Dr. S. F. Blake, who collected it in 1927 and who has rendered much aid to the writer during the course of this monographic study.

42. *G. hirsutula* Hook. & Arn. Bot. Beechey Voy. 147. 1833; DC. Prodr. 7: 278. 1838; Torr. & Gray, Fl. N. Am. 2: 247. 1842, in large part, but excluding *G. rubricaulis* DC.; Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, in small part, excluding *G. rubricaulis* and excluding plants from Monterey and along the coast to Puget Sound; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in small part, excluding *G. rubricaulis* and plants from Monterey; Greene, Fl. Franc. pt. 4. 362. 1897, as to name only.

G. rubricaulis DC. acc. to Greene, Man. Bot. San Franc. Bay Reg. 171. 1894, as to name only; acc. to Jepson, Fl. W. Mid. Cal. 555. 1901, and ed. 2. 462. 1911, as to name only; acc. to Jepson, Man. Fl. Pl. Cal. 1020. 1925, as to name only.

Herbaceous perennial; stems slender, the floriferous branchlets few, simple or scarcely and remotely loosely branched with solitary terminal heads, mostly reddish- or purplish-brown to buff, villous- or crisp-pubescent, 2.7–4 dm. tall; leaves submembranaceous, dull olive-green, scarcely resinous-punctate, remotely serrate or denticulate to entire, the middle and lower cauline 1.6–8 cm. long, 0.4–1.5 cm. broad, 3–7 times longer than broad, those on the floriferous branchlets only gradually reduced near the heads, oblong or oblong-spatulate to (the upper) oblong-lanceolate, obtuse to acute, subamplexicaul to (the upper) amplexicaul, crisp- or villous-puberulent; heads 3.8–5.5 cm. broad; disk campanulate-hemispherical, 0.9–1.6 cm. high, 2–2.6 cm. broad; involucre resinous mostly about tips of bracts and on the innermost bracts, 4–5-seriate, the inner and middle bracts erect with mostly straight flattened tips, the outer and middle hirsutulous throughout; rays 25–40, bright yellow, the lamina 14–20 mm. long; stigmas oblong-lanceolate, moderately exserted; achenes oblong, 4–4.5 mm. long, about 2 mm. broad, dark or fulvous-brown, furrowed or ribbed, 2–3-toothed or bordered at apex with an undulate crown; awns 2–4 to the floret, 3.5–6.5 mm. long, $\frac{3}{4}$ – $\frac{7}{8}$ length of disk-floret, entire to remotely serrulate.

Distribution: near the coast, Marin and San Mateo Counties, west-central California.

CALIFORNIA: Sausalito, Marin Co., June 9, 1912, *Eastwood 280* (CAS, G, M, NY, US); Sausalito, Marin Co., June, 1928, *Eastwood* (CAL, CAS); “California,” *Beechey* (CAL fragment and photograph of TYPE, G, US photograph of TYPE); Sausalito Hills, Marin Co., July 23, 1933, *J. T. Howell 11454, 11455, 11456* (CAS, M); hills south of Vistacion Valley, San Francisco, July 9, 1933, *J. T. Howell 11436* (CAS, M); Sausalito Hills, Marin Co., April 12, 1933, *J. T. Howell 10996, 10997, 10998* (CAS, M).

42a. f. patens (Greene) Steyermark, comb. nov.

G. patens Greene, Pitt. 2: 290. 1892; Man. Bot. San Franc. Bay Reg. 172. 1894; Fl. Franc. pt. 4. 362. 1897.

G. robusta var. *patens* (Greene) Jepson, Fl. W. Mid. Cal.

554. 1901, and ed. 2. 462. 1911, in major part and excluding plants from Santa Cruz Mountains west of Gilroy; Jepson, Man. Fl. Pl. Cal. 1020. 1925, in major part.

G. robusta var. *maritima* (Greene) Jepson, Fl. W. Mid. Cal. 554. 1901, and ed. 2. 461. 1911, excluding *G. rubricaulis* var. *maritima*; Jepson, Man. Fl. Pl. Cal. 1020. 1925, excluding *G. rubricaulis* var. *maritima*.

Stems lightly or not at all villous-pubescent below, becoming densely villous-pubescent towards the heads, simple or sparingly branched with elongated corymbose branches bearing solitary heads, 1.5–3 or more dm. tall, conspicuously foliose with more or less congested leaves; leaves subtending heads crowded and not reduced, crisp- or loosely villous-puberulent; disk 1.3–1.5 cm. high, 2–2.5 cm. broad; involucral bracts moderately to densely villous or lanate-pubescent, the outer becoming enlarged and foliaceous, usually equalling or surpassing the disk, erect to spreading or the outer and middle with slightly recurved tips, lanceolate or broadly- to ovate-lanceolate, acute; awns 2–6 to the floret, entire.

Distribution: Berkeley hills, Alameda Co., San Mateo, and Marin Counties, western-middle California.

CALIFORNIA: summit of Coast Range, San Mateo Co., May 10, 1902, *Baker 812* (G, M, NY, PO, US); near Saratoga, Santa Cruz Mts., alt. 700 ft., May 19, 1906, *Pendleton 351* (CAL); Crystal Springs Lake, San Mateo Co., May 1, 1902, *Baker 687* (PO); San Andreas Lake, San Mateo Co., April 8, 1903, *Baker* (PO); Crystal Springs, San Mateo Co., June 10, 1912, *Eastwood 322* (CAS, G, NY, US); redwoods, near San Francisco, 1866, *Kellogg* (CAL); Berkeley, 18—, *Klee* (CAL); Berkeley hills, May 31, 1896, *Jepson* (CAL); shallow soil overlying serpentine, Crystal Springs Lake, San Mateo Co., May 26, 1933, *J. T. Howell 11348* (CAS, M); Berkeley, July, 1881, *Greene* (F, N TYPE collection of *G. patens*); Olema, Marin Co., July 4, 1896, *Eastwood* (CAL COTYPE of *G. robusta* var. *maritima*); Pilarcitos Lake and Cañon, San Mateo Co., June 21–23, 1893, *Davy* (CAL COTYPE of *G. robusta* var. *maritima*).

42b. f. *cacumena* Steyermark, f. nov.⁵⁷

Stems 2.5–3.8 dm. long, densely villous- to lanate-pubescent;

⁵⁷ *G. hirsutula* f. *cacumena* Steyermark, f. nov., caulibus 2.5–3.8 dm. longis, dense villosis- vel lanato-pubescentibus; foliis congestis, lanatis vel dense villosis; bracteis involucri congestis, numerosis, 7–8-seriatis, anguste vel linearilanceolatis cum apicibus brevibus subulatis plerumque recurvatis vel reflexis, dense villosiusculis vel lanato-pubescentibus.—Collected on Oakland Hills, California, alt. 2000 ft., 1866, *Bolander 389* (U. S. Nat. Herb. TYPE, NY isotype).

leaves crowded, densely villous-pubescent, becoming wooly at the base; involucre bracts crowded, numerous, in 7-8 series, narrowly or linear-lanceolate with short subulate mostly recurved or reflexed tips, rather densely villous or lanate-pubescent.

Distribution: Oakland hills, west-central California.

CALIFORNIA: Oakland hills, alt. 2000 ft., 1866, *Bolander 389* (NY, US TYPE).

42c. var. brevisquama Steyermark, var. nov.⁵⁸

G. hirsutula of most authors, at least in part, not Hook. & Arn.; acc. to Torr. & Gray, Fl. N. Am. 2: 247. 1842, in part, and excluding *G. rubricaulis*; acc. to Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, in part, and excluding *G. rubricaulis* and plants from Monterey and along coast to Puget Sound; acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in part, and excluding *G. rubricaulis*.

G. rubricaulis of most authors, at least in part, not DC.; acc. to Greene, Man. Bot. San Franc. Bay Reg. 171. 1894; acc. to Greene, Fl. Franc. pt. 4. 362. 1897; acc. to Jepson, Fl. W. Mid. Cal. 554. 1901, and ed. 2. 462. 1911, in large part; Man. Fl. Pl. Cal. 1020. 1925, in large part.

Stems crisp- or villous-pubescent, 3-8 dm. tall; leaves remotely to closely dentate or denticulate to entire, the radical and sometimes the lower cauline incised-dentate or pinnatifid, the middle and lower cauline 3-10 cm. long, 0.5-2 cm. broad, 4½-9 times longer than broad, linear-oblong to oblong-oblong-olate, mostly narrowed at base to subpetiolate, those on flo-

⁵⁸ *G. hirsutula* var. *brevisquama* Steyermark, var. nov., caulibus praesertim supra medium plus minusve laxe villosopubescentibus, 3-8 dm. altis; foliis remote vel contigue dentatis vel denticulatis vel integris, caulinis mediis et inferioribus 3-10 cm. longis, plerumque 0.5-2 cm. latis, 4½-9 plo longioribus quam latis, lineari-oblongis vel oblongo-oblongolatis, plerumque ad basem attenuatis vel subpetiolatis, illis in ramusculis floriferis plerumque adversum capitula contractis, crispo- vel villosopuberulis; disco minore quam apud speciem, 0.8-1.1 cm. alto, 1-2 cm. lato; bracteis involucri plerumque erectis et appressis (exterioribus et mediis paullum patentibus vel subsquarrosis), exterioribus non foliaceis, 3-7 mm. longis, late vel ovato-lanceolatis cum apicibus acutis vel breviter subulatis, glabris vel puberulis.—Collected in shallow clay soil of rocky hill, Black Point Road, Sonoma Co., California, July 13, 1930, *J. T. Howell 5338* (Cal. Acad. Sci. Herb. no. 187939 TYPE, CAL isotype).

riferous branchlets mostly reduced towards heads, especially the upper leaves crisp- or villous-puberulent on both surfaces; heads smaller than the species, 2.5–3.5 cm. broad; disk smaller, 0.8–1.1 cm. high, 1–2 cm. (sometimes 2.5 cm.) broad; involucre more conspicuously resinous, the bracts erect and appressed, the outer ones 3–7 mm. long, outer and middle slightly spreading or subsquarrose at the tips, broadly or ovate-lanceolate with acute to short subulate tips, glabrous to puberulent; rays mostly 10–15 mm. long.

Distribution: clay or rocky, grassy or semi-wooded slopes and hillsides, Napa, Marin, Sonoma, Contra Costa, and San Mateo Counties, west-central California, and locally south in San Luis Obispo Co.

CALIFORNIA: open slopes, hills 2 miles west of Belmont, San Mateo Co., May 25, 1932, *Keck 1873* (P); Calistoga, June, 1881, *Greene* (M, N); on the hills south-east of Napa, July 26, 1913, *Suksdorf 670* (M); Napa, April 24, 1924, *M. E. Jones* (PO); Napa, 1899, *Smyth* (G); Rebecca Ranch grade, April 30, 1894, *Jepson* (CAL); near St. Helena Sanitarium, Napa Co., July 2, 1916, *Abrams 5751* (NY); shallow clay soil of rocky hill, Black Point Road, Sonoma Co., July 13, 1930, *J. T. Howell 5338* (CAL, CAS TYPE); clay soil, 4 mi. from Santa Rosa on road to Sonoma, Sonoma Co., June 9, 1929, *J. T. Howell 4304* (CAL, M, NY, US); north hillside, School Cañon, April 10, 1908, *Condit* (CAL); Knight's Valley, June 14, 1894, *Greene* (N); Ignatio, Marin Co., April 27, 1918, *Abrams 6889* (ST); Angel Island, San Francisco Bay, 1877, *Rattan* (ST); summit of Cuesta Pass, San Luis Obispo Co., July 2, 1933, *J. T. Howell 11415* (CAS, M); White's Hill, between Fairfax and Woodacre, Marin Co., July 30, 1933, *J. T. Howell 11463* (CAS, M).

42d. var. brevisquama f. glabrata Steyermark, f. nov.⁵⁹

Stems practically glabrous; leaves mostly glabrous, firmly membranaceous to submembranaceous; involucre bracts glabrous.

Distribution: rocky or clay slopes, Sonoma Co., west-central California.

CALIFORNIA: clay soil, 8 mi. west of Petaluma, on Bodega Road, Sonoma Co., June 8, 1930, *J. T. Howard 5222* (CAS), and *5221* (M TYPE, CAS, G, PO, isotypes); Oakland, *Bolander 89* (M); rocky slope, 1 mi. east of Bodega Bay, Sonoma Co., June 8, 1930, *J. T. Howell 5256* (CAL, CAS); Glen Ellen, Sonoma Co., June, 1893, *Michener & Bioletti* (M, NY, PO).

⁵⁹ *G. hirsutula* var. *brevisquama* f. *glabrata* Steyermark, f. nov., caulibus plus minusve glabris; foliis plerumque glabris, firme membranaceis vel submembranaceis; bracteis involucri glabris.—Collected in clay soil, 8 miles west of Petaluma, on Bodega Road, Sonoma Co., California, June 8, 1930, *J. T. Howell 5221* in part (Mo. Bot. Gard. Herb. no. 1016008 TYPE, CAS, G, PO, isotypes).

42e. var. brevisquama f. tomentulosa Steyermark, f. nov.⁶⁰

G. hirsutula Hook. & Arn. acc. to Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, in part, and excluding *G. rubricaulis* and plants from Monterey and along coast to Puget Sound; acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in part as to plant of *Kellogg* at Gray and Mo. Bot. Gard. Herb.

G. rubricaulis DC. acc. to Jepson, Fl. W. Mid. Cal. 554. 1901, and ed. 2. 462. 1911, in part as to plant of *Setchell* near Mt. Tamalpais; Man. Fl. Pl. Cal. 1020. 1925, in part as to plant of *Setchell* near Mt. Tamalpais.

Involucral bracts densely hirsutulous to tomentulose.

Distribution: dry banks and hillsides, mostly in the mountains, Marin, San Mateo, and Santa Clara Counties, California.

CALIFORNIA: redwoods, near San Francisco, 1866, *Kellogg* in part (G, M); dry bank (shale and sandstone), Los Trancos, Searsville Ridge, San Mateo Co., June 24, 1927, *Blake 9943* (G); dry bank, near Crystal Springs Lake, San Mateo Co., June 25, 1927, *Blake 9949* (G); Crystal Springs Lake, June 23, 1913, *Suksdorf 279* (M TYPE); Black Pt., Marin Co., *Hichborn* (ST); exposed slope, Pescadero-La Hondo Road, San Mateo Co., July 3, 1921, *Mason* (ST); Stanford University, Santa Clara Co., April, 1900, *Atkinson* (ST).

42f. var. brevisquama f. pedunculoides Steyermark, f. nov.⁶¹

Stems stout, sparsely or loosely crisp- or villous-puberulent, branching above with several stout elongated floriferous branchlets 1.5–4 dm. long; leaves entire to serrulate, 8–10 cm. long, 1.2–1.6 cm. broad, oblong, subamplexicaul, those on the floriferous branchlets reduced towards the heads, the upper scattered and much reduced, crisp- or villous-puberulent on both surfaces; disk 1.0–1.2 cm. high, 1.7–2 cm. broad; involucral bracts glabrate to puberulent.

⁶⁰ *G. hirsutula* var. *brevisquama* f. *tomentulosa* Steyermark, f. nov., bracteis involucri dense hirsutulis vel tomentulosis, multo pubescentioribus quam var. *brevisquama*.—Collected at Crystal Springs Lake, San Mateo Co., California, June 23, 1913, *Suksdorf 279* (Mo. Bot. Gard. Herb. no. 850778 TYPE).

⁶¹ *G. hirsutula* var. *brevisquama* f. *pedunculoides* Steyermark, f. nov., caulibus robustis, parce vel laxè crispo- vel villosopuberulis, supra ramosis cum ramusculis floriferis paucis robustis elongatis; foliis integris vel serrulatis, 8–10 cm. longis, 1.2–1.6 cm. latis, oblongis, subamplexicaulibus, illis in ramusculis floriferis ad- versus capitula reductis; ramusculis floriferis 1.5–4 dm. longis, ut videtur prope capitula pedunculiformibus; disco 1–1.2 cm. alto, 1.7–2 cm. lato; bracteis involucri glabratis vel puberulis.—Collected at Calistoga, California, May 7, 1900, *Eastwood* (Univ. Cal. Herb. TYPE, G isotype).

Distribution: Napa Co., California.

CALIFORNIA: Calistoga, May 7, 1900, *Eastwood* (CAL TYPE, G).

42g. var. calva Steyermark, var. nov.⁶²

Stems glabrous to sparsely puberulent; leaves firm and subcoriaceous, the main cauline 2–5.5 cm. long, 0.4–1 cm. broad, 5–9 times longer than broad, linear or linear-oblong, mostly acute, about as broad at the base as at the middle, scabridulous along the margins or sometimes on the surface, the lower and middle cauline rather closely serrulate or denticulate with short sharply acute to subspinulose-tipped teeth from base to apex (rarely subentire); involucral bracts glabrous or glabrate, 4–6-seriate, 4–8 mm. long, linear-lanceolate to lanceolate, gradually acuminate, appressed or very slightly spreading at the tips, the outer bracts short.

Distribution: San Luis Obispo Co., southern California.

CALIFORNIA: San Luis Obispo, spring, 1905, *Roadhouse 65* (CAL TYPE); San Luis Obispo, June 26, 1876, *Ed. Palmer 249* (CAL, NY, US).

42h. var. subintegra Steyermark in Ann. Mo. Bot. Gard. 21: 229. 1934.

Stems more or less puberulent; leaves entire or subentire, sometimes the basal and others serrate, oblong to ovate-oblong, 2–13 cm. long, 0.7–3.5 cm. broad, finely puberulent to glabrate, the upper with subamplexical bases; involucral bracts 3–7 mm. long, glabrous, with erect or ascending short acute to acuminate tips.

Distribution: dry open hills and fields, Ventura Co., southern California.

CALIFORNIA: on grassy hillside, 2 mi. east of Ojai, Ventura Co., July 1, 1933, *J. T. Howell 11414* (M TYPE, CAS isotype); dry field, Ojai, Ventura Co., June 4, 1927, *Hoffmann* (SB).

The identification of this species with *G. rubricaulis* by many authors has led to the greatest amount of disorder among the Californian species. An examination of a fragment and photograph of the type of *G. hirsutula* shows the stems villous- or

⁶² *G. hirsutula* var. *calva* Steyermark, var. nov., caulibus plerumque glabris, simplicibus; foliis firmis et subcoriaceis, contigue serrulatis vel denticulatis cum dentibus brevibus acutis vel subspinulosis, glabris; bracteis involucri glabris vel glabratibus.—Collected at San Luis Obispo, California, spring of 1905, *F. E. Roadhouse 65* (Univ. Cal. Herb. TYPE).

crisp-pubescent and the outer and middle involueral bracts hirsutulous throughout; the inner and middle bracts are erect with mostly straight tips, while the outer are loose with spreading or slightly recurved slender tips; some of the heads are immediately subtended by slightly enlarged upper leaves; this type of involucre is matched by present collections obtained from the Sausalito Hills region northwest across San Francisco Bay from San Francisco, which may be where Lay and Collie collected their plant although it is more likely that they obtained it from San Francisco. The historical type of *G. hirsutula* may therefore be identified with a form common around Sausalito, a form which is a less usual phase of the *G. hirsutula* group. The commoner type of involucre is represented by var. *brevisquama* and forms, in which the bracts are more obviously graduated and appressed, and are broadly or ovate-lanceolate with shorter acute to short subulate erect tips. A more foliaceous development of the involueral bracts occurs especially in the Berkeley hills region of California. Greene described this foliaceous type as a species, *G. patens*, but detailed study of the *G. hirsutula* group shows various intergradations between the type of involucre in *G. hirsutula* and in *G. patens*, so that *G. patens* should, at most, be recognized as only an extremely foliaceous form of *G. hirsutula*.

Some authors, notably Jepson and Greene, in treating *G. hirsutula* and *G. rubricaulis* conspecifically, gave priority to *G. rubricaulis* DC. (1836) over *G. hirsutula* Hook. & Arn. (1833). There is no justification for this view, however, since the proper date of publication for *G. hirsutula* Hook. & Arn. is 1833, rather than later as was assumed, and that of *G. rubricaulis* DC. is 1836.

43. *G. maritima* (Greene) Steyermark, comb. nov.

G. glutinosa (Cav.) Dunal acc. to Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, as to plant from Fort Point.

G. rubricaulis DC. var. *maritima* Greene, Pitt. 2: 289. 1892; Man. Bot. San Franc. Bay Reg. 172. 1894; Jepson, Fl. W. Mid. Cal. 554. 1901, and ed. 2. 461. 1911, as to synonym only; Man. Fl. Pl. Cal. 1020. 1925, as to synonym only.

G. robusta var. *maritima* (Greene) Jepson, Fl. W. Mid. Cal. 554. 1901, and ed. 2. 461. 1911, as to name-bringing synonym, not as to description nor plants from Olema and Pilarcitos; Man. Fl. Pl. Cal. 1020. 1925, as name-bringing synonym, not as to description nor plants from Olema and Pilarcitos.

Herbaceous perennial; stems decumbent to ascending, often leaning, slender, the floriferous branchlets loosely corymbosely branched with elongated divergent branchlets bearing few heads, or the branchlets simple or scarcely branched and sometimes with only 1 head, mostly rufous-brown to reddish-purple, usually glabrous, 3.5–5 or more dm. tall; leaves mostly firm and subcoriaceous, pale grass-green to bright green, inconspicuously resinous-punctate, the main cauline closely crenate, sinuate-dentate to dentate or subentire, those on the floriferous branchlets denticulate to entire, basal and lowermost leaves never incised-dentate or pinnatifid, the main middle and lower cauline 3.5–8 cm. long, 0.9–2.8 cm. broad, 3–6 times longer than broad, those on floriferous branchlets 1–3 cm. long, 0.5–1 cm. broad, 2–3½ times longer than broad, the main middle and lower cauline oblong-spatulate or oblong-ob lanceolate to broadly or ovoid-oblong, mostly obtuse, amplexicaul, those on floriferous branchlets ovate-oblong or oblong-lanceolate, acute to obtusish, amplexicaul, glabrous; head 3.5–4.2 cm. broad; disk campanulate-hemispherical, 0.9–1.2 cm. high, 1.7–2 cm. broad; involucre resinous, especially so before anthesis, 4–5-seriate, the bracts mostly erect and appressed or the short upper fourth to fifth spreading or ascending (rarely reflexed), 4–9 mm. long, mostly lanceolate to oblong-lanceolate with rather abruptly acuminate or short caudate flattened tips, glabrous; receptacle conspicuously foveolate; rays 25–35, bright orange-yellow, the lamina 11–15 mm. long; stigmas oblong-lanceolate, moderately exserted; achenes 3.5–4.2 mm. long, 1.8–2 mm. broad, oblong, light brown to dark brown, irregularly furrowed or ribbed, apex slightly bordered or with 2–3 short knobs or projections; awns mostly 2 to the floret, stoutish, remotely to numerously serrulate or setulose, 3–5.2 mm. long, $\frac{2}{5}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: sandy or serpentine dry slopes adjacent to the ocean, at the tip of the peninsula around San Francisco, Presidio, Pt. Lobos, Fort Winfield Scott, and Lake Merced in San Mateo Co., central California.

CALIFORNIA: Lake Merced, Oct. 20, 1897, *Davy* (CAL); San Francisco, Sept., 1901, *T. S. Brandegees* (CAL); Lake Merced, San Francisco, Oct. 19, 1924, *J. T. Howell 709* (CAS); shallow soil overlying serpentine, Presidio near Fort Point, San Francisco, Aug. 11, 1933, *J. T. Howell 11489* (CAS, M); San Francisco, Aug., 1891, *T. S. Brandegees* (CAL); dry banks, Presidio, San Francisco, July 6, 1927, *Blake 10000* (G); summit of Twin Peaks, San Francisco, Sept. 15, 1933, *J. T. Howell 11661* (CAS, M); dry hill, Presidio, San Francisco, July 6, 1927, *Blake 9998* (G); sandy bluffs, Lincoln Park, San Francisco, Aug. 3, 1927, *Blake 10159* (G); exposed slope near sea, Ft. Winfield Scott, San Mateo Co., alt. 35 m., Aug. 8, 1931, *Moore & Steyermark 3685* (M); Lake Merced, San Francisco, Oct. 5, 1895, *Eastwood* (G); Pt. Lobos, Aug. 12, 1892, *Greene* (CAL, N TYPE); Laguna Honda, San Francisco, Sept. 15, 1933, *J. T. Howell 11656 and 11657* (CAS, M).

43a. f. *anomala* Steyermark, f. nov.⁶³

Stems pubescent; leaves glabrate to sparsely pilose on midrib beneath.

Distribution: region of San Francisco, San Mateo Co., California.

CALIFORNIA: Laguna Honda, San Francisco, Sept. 15, 1933, *J. T. Howell 11658* (M TYPE, CAS isotype); summit of Twin Peaks, San Francisco, Sept. 15, 1933, *J. T. Howell 11662* (CAS, M cotype); summit of Twin Peaks, San Francisco, Sept. 15, 1933, *J. T. Howell 11660* (CAS, M).

The complexities of *Grindelia* must indeed have been overwhelming for Greene to have described two varieties within one genus, an act which he committed for *G. rubricaulis* var. *maritima* Greene and *G. robusta* var. *platyphylla* Greene. One might suppose that if Greene, notorious splitter that he was, described them as varieties, they might automatically become mere forms or direct synonyms, but the curious point is that *G. rubricaulis* var. *maritima* should be elevated to specific rank and considered a fairly distinct species. True, it does show close affinity to *G. hirsutula*, with which Greene intended to indicate its varietal relationship (he placed it under *G. rubricaulis* which at that time was considered synonymous with and published before *G. hirsutula*). Although *G. maritima* sometimes approaches glabrous forms of *G. hirsutula*, it may usually be distinguished from that species by the com-

⁶³ *Grindelia maritima* f. *anomala* Steyermark, f. nov., caulibus et foliis pubescentibus. Collected at Laguna Honda, San Francisco, Sept. 15, 1933, *J. T. Howell 11658* (Mo. Bot. Gard Herb. no. 1044116 TYPE, CAS isotype).

ination of mostly glabrous stems and glabrous firmer leaves which have more amplexicaul leaf-bases, more divergently and loosely corymbose branchlets, and more numerous serrulate pappus awns. Moreover, the basal and lowermost leaves of *G. hirsutula* are often incised-dentate or pinnatifid, whereas in



Fig. 35. *G. hirsutula*. $\times \frac{1}{6}$. Fig. 36. *G. maritima*. Fig. 37. *G. rubricaulis*.
 $\times \frac{1}{6}$. $\times \frac{1}{6}$.

G. maritima they are never pinnatifid or deeply dentate. In *G. maritima* the leaves on the floriferous branchlets are ovate to oblong-lanceolate and strongly amplexicaul, and mostly $2-3\frac{1}{2}$ times longer than broad, whereas in the *G. hirsutula* group they are narrower—oblong to linear—and 3–6 times longer than broad. Although it is admitted that *G. maritima*

is very close to *G. hirsutula*, it appears distinct enough in several ways to be maintained as a valid species.

Jepson confused matters greatly in transferring Greene's *G. rubricaulis* var. *maritima* to *G. robusta* with which it is not related. Moreover, he misinterpreted *G. rubricaulis* var. *maritima* Greene, since he not only introduced new heterogeneous elements into its original interpretation by citing plants from Olema and Pilarcitos, but also, in identifying Greene's variety with *G. robusta*, he caused *G. robusta* var. *maritima* to become a name-bringing synonym of *G. maritima* (*G. rubricaulis* var. *maritima* Greene). The plants from Olema and Pilarcitos are conspecific with *G. hirsutula* f. *patens*, and thus *G. robusta* var. *maritima*, excluding *G. rubricaulis* var. *maritima*, is both a direct synonym (as to *G. hirsutula* f. *patens*) and a name-bringing synonym (as to *G. maritima*).

44. *G. rubricaulis* DC. Prodr. 5: 316. 1836, not *G. rubricaulis* of authors, which is *G. hirsutula* Hook. & Arn.; Torr. & Gray, Fl. N. Am. 2: 247. 1842, as to synonym, plant of Douglas, and description in part; Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, as to synonym mainly; Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as to synonym, plant of Douglas, and description in part; Greene, Man. Bot. San Franc. Bay Reg. 171. 1894, as to name only; Jepson, Fl. W. Mid. Cal. 555. 1901, and ed. 2. 462. 1911, as to name only; Man. Fl. Pl. Cal. 1020. 1925, as to name only.

G. hirsutula Hook. & Arn. acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, in part, at least as to description "with . . . subulate-attenuate squarrose tips and with . . . the surrounding loose foliaceous bracts" and plants of Brewer 657 (Guirado), Kellogg (in part, specimens in Gray and U. S. Nat. Herb.) and Douglas 55.

Herbaceous perennial; stems slender, reddish-purple or purplish-brown to sometimes buff or greenish-brown below, more or less villous-pubescent above the middle, 2.7–8 dm. tall; leaves firmly membranaceous, dark green, scarcely resinous-punctate, the main cauline remotely to coarsely and sometimes saliently or incised-dentate, the upper saliently den-

tate or more often becoming entire, the main lower and middle cauline 5–11 cm. long, 1–2.5 cm. broad, 4 to 5½ times longer than broad, those on the elongated floriferous branchlets 1.0–4 cm. long, 0.4–1.3 cm. broad, 2½–5 times longer than broad, the main middle and lower cauline oblong or oblong-spatulate, mostly obtuse or obtusish, subamplexicaul or narrowed at base, the middle cauline subamplexicaul, the upper cauline and those on floriferous branchlets triangular-ovate or ovate-lanceolate to lanceolate, acute, strongly amplexicaul, mostly sparsely villous or crisp-pubescent on both surfaces or (especially the lower) becoming glabrate, the margins usually villous-ciliate; heads mostly 4–5 cm. broad; disk depressed-hemispherical, 1.0–1.3 cm. high, 1.7–2.5 cm. broad; involucre moderately resinous on the innermost bracts, bracts mostly 5–6-seriate, 4–10 mm. long, the upper fifth to half free and moderately to strongly reflexed, the outermost becoming loose and foliaceous and passing more or less into the subtending involucreal leaves, the outer and middle linear-lanceolate to lanceolate with subulate or long acuminate mostly flattened tips, crisp- or villous-pubescent to hirsutulous, sometimes glabrate; rays 27–35, bright chrome-yellow to orange-yellow, the lamina 12–18 mm. long; stigmas oblong-lanceolate; achenes oblong, 3–4 mm. long, 1.5–1.7 mm. broad, light brown to buff, smooth to slightly striated or furrowed, obliquely bordered at apex with an auriculate undulate crown; awns 2–7 to the floret, stout or stoutish, entire to remotely serrulate, 2.8–5.2 mm. long, often ½–⅔ length of disk-floret.

Distribution: Santa Clara, Santa Cruz, Monterey, and San Benito Counties, California.

CALIFORNIA: in pasture near Pescadero Ranch, Monterey Co., May 25, 1861, *Brewer 657 (Guirado)* (CAL, G, US); near Del Monte Lodge on Carmel Bay, Monterey Co., among *Pinus radiata*, Aug. 19, 1933, *J. T. Howell 11602* (CAS, M); near Santa Rita, Monterey Co., May, 1889, *Abbott* (CAS); 1833, *Douglas 55* (CAL photograph and fragment of TYPE, G isotype and photograph of TYPE, M photograph of TYPE); Monterey, June 14, 1889, *K. Brandegee* (CAL); Santa Lucia Mts., Monterey Co., Aug. 1885, *T. S. Brandegee* (G); pine forest at Pacific Grove, Aug. 16, 1905, *Coleman* (ST); Swanton, spring of 1912, Santa Cruz Co., *Rich* (ST); Swett's Ranch, May 22, 1887, *Rattan* (ST); Pacific Grove, June 12, 1907, *Patterson & Wiltz* (ST).

44a. var. permixta Steyermark, var. nov.⁶⁴

Stems glabrous to more or less villous-pubescent, simple or sparingly branched above; leaves dentate or denticulate to entire, the main middle and lower cauline 4–6.5 cm. long, 0.5–0.8 cm. broad, 6–9 times longer than broad, the upper 1.5–4 cm. long, 1.5–6 mm. broad, 6–12 times longer than broad, narrowly oblanceolate to linear-oblong or lanceolate, acute to acuminate, subamplexicaul or not narrowed at the base, glabrous to more or less villous-pubescent; involucral bracts crowded, numerous, slender, the outer becoming foliaceous, the free upper portion deflexed to rather openly recurved, linear- to narrowly lanceolate with slender subulate tips, glabrous to more or less villous-puberulent.

Distribution: rocky bluffs and open places, about Oakland and San Leandro, Alameda Co., California.

CALIFORNIA: rocky bluff, San Leandro, Alameda Co., July 22, 1929, *J. T. Howell 4352* (CAS TYPE); San Leandro, June, 1888, *Underwood* (NY); San Leandro, Contra Costa Co., June 21, 1915, *Eastwood 4730* (CAS, US); East Oakland, July 7, 1907, *Walker 689* (CAL).

44b. var. elata Steyermark in Ann. Mo. Bot. Gard. **21**: 227. 1934.

G. camporum Greene acc. to Abrams, Fl. Los Ang. & Vic. 393. 1904, and ed. 2. 360. 1917, as to plant from Wiseburn only; acc. to Hall, U. Cal. Publ. Bot. [Compos. S. Cal.] **3**: 39. 1907, only as to plants of *Cleveland*, *Chandler 5358*, *Hall 6726*, and *Brandeggee*, Ramona, July 10, 1903.

G. robusta Nutt. acc. to Jepson, Man. Fl. Pl. Cal. 1020. 1925, in small part and especially as to plants from San Diego Co.

Stems erect, one to few, stout, strongly corymbosely branch-

⁶⁴ *G. rubricaulis* var. **permixta** Steyermark, var. nov., caulibus glabris, plus minusve villosopubescentibus, simplicibus vel supra parce ramosis; foliis caulinis principalibus inferioribus et mediis dentatis vel denticulatis vel integris, 4–6.5 cm. longis, 0.5–0.8 cm. latis, 6–9 plo longioribus quam latis, lineari-oblongis vel lanceolatis vel anguste oblanceolatis, superioribus plerumque integris vel denticulatis, 1.5–4 cm. longis, 1.5–6 mm. latis, 6–12 plo longioribus quam latis, lanceolatis vel lineari-lanceolatis vel linearibus, glabris vel plus minusve villosopubescentibus; bracteis involucri congestis, tenuibus, exterioribus foliaceis, parte superiore libera lineari- vel anguste lanceolata, apicibus tenuibus villosopuberulis.—Collected on rocky bluff, San Leandro, Alameda Co., California, July 22, 1929, *J. T. Howell 4352* (Cal. Acad. Sci. Herb. no. 165887 TYPE).

ed above with mostly elongated ascending floriferous branchlets usually bearing many heads, mostly buff or stramineous, glabrous, 6–12 dm. tall; leaves firmly membranaceous or subcoriaceous, dark green or olive-green, moderately to abundantly resinous-punctate, coarsely or saliently dentate or serrate with acute to sharply acuminate teeth, or finely serrate, those on the floriferous branchlets often entire or subentire, the main middle and lower cauline 3.5–7.5 cm. long, 0.7–1.8 cm. broad, 3–9 times longer than broad, those on floriferous branchlets numerous, 1–2.3 cm. long, 0.2–1 cm. broad, mostly $1\frac{1}{2}$ –3 times longer than broad, becoming smaller towards the heads, the main middle and lower cauline linear- or narrowly oblong or oblanceolate to oblong-lanceolate, acute to obtuse, mostly narrowed at the base to subamplexicaul, the upper cauline and those on floriferous branches lanceolate to ovate, acute to acuminate, strongly amplexicaul, glabrous except for the scabridulous margins; involucre conspicuously and abundantly resinous, about 6–7-seriate, the upper $\frac{1}{5}$ – $\frac{1}{3}$ of the bracts strongly reflexed to revolute, those at the base mostly crowded and revolute, infrequently loose or foliaceous, tips thickened and subcoriaceous; lamina of rays 8–12 mm. long; awns 2–3 to the floret, mostly 2, entire, $\frac{1}{2}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: dry hills and canyons in mountains, clay soil of coastal mesas and flats, fields and waste places, along the coast and slightly inland, Santa Barbara Co., California; south to the vicinity of San Ysidro, northwestern Lower California. The common gumweed around San Diego and adjacent regions.

UNITED STATES: CALIFORNIA: state highway north of Oceanside, San Diego Co., alt. 100 ft., Dec., 1916, *Reed 3927* (CAL); National City, July 3, 1885, *Cleveland* (CAL); dry mesa, La Presa, San Diego Co., June 6, 1903, *Abrams 3903* (CAL, F, G, M, NY, PA, PO, US); Oceanside, San Diego Co., alt. 0–50 ft., June 11–16, 1897, *Parish 4452* (G, M, MA, NY, US); hills, Los Angeles Co., July, 1889, *Hasse* (M); Lemon Grove, July, 1897, *Rodman* (G); grassland, old clearing, La Jolla, June 6, 1914, *F. E. & E. S. Clements 243* (CAL, F, G, M, NY, PA); hills of Santa Monica Mts. at Santa Monica, Los Angeles Co., May 29, 1931, *J. T. Howell 6562* (CAS); coastal flat at Little Sycamore Creek, Malibu Highway to Oxnard, Ventura Co., May 29, 1931, *J. T. Howell 6566* (CAS, M); Conejo Valley, Ventura Co., May 29, 1931, *J. T. Howell 6573* (CAS); clay hills, 7 mi. southwest of Simi, Ventura Co., May 29, 1931, *J. T. Howell 6574* (CAS TYPE); Ramona, July 10, 1903, *T. S. Brandegee* (CAL, PA); San Diego, 1902, *T. S. Brandegee* (CAL); clay soil of coastal mesa, San Clemente, Orange Co., June 1, 1931, *J. T. Howell 6624* (CAS).

MEXICO: LOWER CALIFORNIA—San Ysidro Ranch, July 2, 1894, *Mearns 3858* (US); San Ysidro, June 28, 1894, *Schoenfeldt 3806* (NY, US).

44c. var. bracteosa (J. T. Howell) Steyermark in Ann. Mo. Bot. Gard. **21**: 227. 1934.

G. bracteosa J. T. Howell in Madroño **2**: 22. 1931.

Stems glabrous, corymbosely branched above with divergently ascending stout floriferous many-headed branchlets; leaves dark green, moderately resinous-punctate, coarsely and sharply serrate to serrulate, the upper cauline and those on floriferous branchlets 2–3 cm. long, 0.5–1.0 cm. broad, 3–3½ times longer than broad, ovate- to oblong-lanceolate, acute, subamplexicaul, those on floriferous branchlets crowded and not reduced below the heads; heads large, discoid; disk depressed-hemispherical, 1.7–2.5 cm. broad, 1.0–1.5 cm. high; involucre conspicuously and abundantly resinous, 6–7-seriate, the bracts strongly reflexed to revolute with thickened and subcoriaceous tips, the outermost bracts at the base mostly crowded and revolute, frequently subtended by foliose leaves; awns 2–6, entire, ½–⅝ length of disk-floret.

Distribution: dry clay soil of hills and canyons, Santa Ana Canyon, Orange Co., Puente and Chino Hills, San Bernardino Co., and Pine Hills, San Diego Co., California.

CALIFORNIA: road to Aliso Canyon, s. Puente Hills, San Bernardino Co., alt. ca. 1000 ft., June 6, 1928, *Johnson* (CAS); in hard dry soil, hills on n. side of Santa Ana Canyon, Orange Co., alt. 600 ft., July 16, 1927, *J. T. Howell 2786* (CAS TYPE); ad silvarum margines Pine Hills, San Diego Co., alt. 1500 m., July 10, 1918, *Spencer* (CAL); heavy soil along the creek banks, Chino Creek south of Ontario, alt. 500 ft., May 26, 1918, *I. M. Johnston* (PO).

44d. var. robusta (Nutt.) Steyermark in Ann. Mo. Bot. Gard. **21**: 227. 1934.

G. robusta Nutt. Trans. Am. Phil. Soc. N. S. **7**: 314. 1841; Torr. & Gray, Fl. N. Am. **2**: 247. 1842; Walp. Rep. Bot. Syst. **2**: 585. 1843; Gray in Geol. Surv. Cal. **1**: 304. 1876; Rothrock, Rept. Wheeler Exp. **6**: 363. 1878; Gray, Syn. Fl. N. Am. **1**²: 119. 1884, and ed. 2. 119. 1888; Abrams, Fl. Los Ang. & Vic. 393. 1904, and 361. 1917, in major part; Perredes, Wellcome Chem. Res. Lab. 65:2, *pl. 1, fig. 1, and 1a*. 1906; Hall in U. Cal. Publ. Bot. [Compos. S. Cal.] **3**: 38. 1907, excluding plant of

Eastwood; Jepson, Man. Fl. Pl. Cal. 1020. 1925, in part and excluding at least plants from San Diego and San Francisco region.

G. cuneifolia Nutt. Trans. Am. Phil. Soc. N. S. 7: 315. 1841, not of authors; acc. to Torr. & Gray, Fl. N. Am. 2: 247. 1842; acc. to Walp. Rep. Bot. Syst. 2: 586. 1843; acc. to Gray, Syn. Fl. N. Am. 1²: 118. 1884, and ed. 2. 118. 1888, as to name and as to plant from Santa Barbara; acc. to Greene, Man. Bot. San Franc. Bay Reg. 172. 1894, as to name only; acc. to Greene, Fl. Franc. pt. 4. 363. 1897, as to name only; acc. to Jepson, Fl. W. Mid. Cal. 555. 1901, and ed. 2. 462. 1911, as to name only; acc. to Abrams, Fl. Los Ang. & Vic. 393. 1904, and ed. 2. 361. 1917, as to name only; acc. to Hall in U. Cal. Publ. Bot. [Compos. S. Cal.] 3: 38. 1907, as to name and as to plant from Santa Barbara, not as to description; acc. to Jepson, Man. Fl. Pl. Cal. 1021. 1925, as to name only.

G. pacifica Jones in Bull. Torr. Bot. Club 9: 31. 1882; Gray, Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888, as synonym.

Stems one to several, stout, the floriferous branchlets bearing few to several heads, glabrous, 4–12 dm. tall, uniformly foliose throughout; leaves firmly membranaceous, moderately resinous-punctate, coarsely saliently dentate or serrate with large broad acute to spinulose teeth, or the uppermost often entire or subentire, 2.5–9 cm. long, 0.7–3 cm. broad, 2–4½ times longer than broad, the main middle and lower cauline oblong to ovate-oblong, obtuse to acute, mostly conspicuously amplexicaul, the upper cauline and those on floriferous branchlets lanceolate to ovate-lanceolate, mostly acute or obtuse, strongly amplexicaul, glabrous except for the scabridulous margins; heads radiate, mostly 3–5 cm. broad; disk depressed-hemispherical, 0.9–1.3 cm. high, 1.5–3 cm. broad; involucre moderately resinous, the upper fourth to half of the bracts free and only moderately reflexed, sometimes spreading, mostly flattened and scarcely thickened, the outermost becoming loose and foliaceous and passing more or less into the subtending involucreal leaves, submembranaceous, glabrous; rays

30-47, lamina mostly 12-17 mm. long; awns 2-7 to the floret, usually stout, entire to remotely serrulate, $\frac{1}{2}$ - $\frac{3}{4}$ length of disk-floret.

Distribution: clay soil of coastal slopes and flats, wet places on coastal mesas and low ground, from Orange Co. north along the coast to San Luis Obispo Bay and Cambria, San Luis Obispo Co., also around Santa Cruz and Monterey Counties, best developed on open coastal slopes in Los Angeles, Santa Barbara, and San Luis Obispo Counties.

CALIFORNIA: near Soldier's Home, Los Angeles Co., Sept., 1905, *Adams* (CAL); Oak Knoll, May 5, 1901, *Braunton* 46 (US); dry soil, Whittier, June, 1892, *McClatchie* (NY); bluffs along shore, Laguna Beach, May 5, 1916, *Crawford* (PO); dry hills overlooking the sea, Carmel Mission, Aug. 10, 1896, *Jepson* (CAL); low ground near Summerland, Santa Barbara Co., Aug. 22, 1904, *Abrams* 4105 (NY); Santa Barbara, July, 1875, *Rothrock* 84 (F, G, US); clay soil of coastal bluff, Summerland, Santa Barbara Co., May 19, 1930, *J. T. Howell* 5179 (CAS); St. Pedro, *Nuttall* (G, PA, isotypes); Avila, San Luis Obispo Co., May 3, 1926, *Eastwood* 13763 (CAS); Elysian Park, Los Angeles Co., June 1, 1902, *Braunton* 399 (US); Aptos, Santa Cruz Co., Oct. 13, 1902, *Abrams* 3072 (PO); Morro, San Luis Obispo Co., alt. 300 ft., June 30, 1927, *Feudge* 1813 (PO); roadside, Morro Creek, San Luis Obispo Co., alt. 300 ft., March 24, 1925, *Munz* 9229 (PO); Summerdale, Santa Barbara Co., May 7, 1902, *H. M. Hall* 3175 (CAL); foothills back of Santa Barbara (Montarioso), alt. 400 ft., May 14, 1907, *H. M. Hall* 7712 (CAL); near Morro, San Luis Obispo Co., May 25, 1892, *Summers* (CAL); Santa Barbara, *Nuttall* (G isotype of *G. cuneifolia*); Seabright, Santa Cruz Co., July 6, 1920, *Hichborn* 321 (ST); Santa Cruz, Santa Cruz Co., Oct. 3, 1896, *Dudley* (ST); coast trail, Monterey Co., Aug. 17, 1903, *Dudley* (ST).

44e. var. *latifolia* (Kellogg) Steyermark in Ann. Mo. Bot. Gard. **21**: 227. 1934.

G. latifolia Kellogg in Proc. Cal. Acad. **5**: 36. 1873; Gray in Geol. Surv. Cal. Bot. **1**: 304. 1876; Syn. Fl. N. Am. **1**²: 119. 1884, and ed. 2. 119. 1888, as synonym; Greene, Pitt. **1**: 89. 1887; Hall in U. Cal. Publ. Bot. [Compos. S. Cal.] **3**: 37. 1907; Jepson, Man. Fl. Pl. Cal. 1020. 1925, as synonym.

G. glutinosa (Cav.)⁶⁵ Dunal acc. to Gray, Syn. Fl. N. Am. **1**²:

⁶⁵ The name *Grindelia glutinosa* has been so misinterpreted that it seems appropriate at this place to give it discussion, especially since it has not been satisfactorily placed by Cabrera in his revision of the South American species of *Grindelia*.

Grindelia glutinosa (Cav.) Dunal in Mem. Mus. Par. **5**: 49. 1819; acc. to Gray in Geol. Surv. Cal. Bot. **1**: 303. 1876, as to synonymy, not as to specimens cited from California; acc. to Gray, Syn. Fl. N. Am. **1**²: 119. 1884, and ed. 2. 119. 1888, as to synonymy mostly.

Aster glutinosus Cav. Ic. **2**: 53. pl. 168. 1793.

Doronicum glutinosum Willd. Sp. Pl. **6**²: 2115. 1800.

Inula glutinosa Pers. Syn. Pl. **2**: 452. 1807.

119. 1884, and ed. 2. 119. 1888, only as to plants of Santa Barbara Island, California, and including reference to *G. latifolia*; acc. to Brandege in Proc. Cal. Acad. II. 1: 211. 1888.

G. robusta Nutt. acc. to Hall, U. Cal. Publ. Bot. [Compos. S. Cal.] 3: 38. 1907, as to plants of *Eastwood* only.

G. robusta var. *latifolia* (Kellogg) Jepson, Man. Fl. Pl. Cal. 1020. 1925; Gray in Geol. Surv. Cal. Bot. 1: 304. 1876.

Stems stout, subcorymbosely branched above, with stout divergently ascending floriferous branchlets bearing few heads, 5 or more dm. tall; leaves pale or grayish-green, slightly resinous-punctate, the main cauline remotely dentate or serrate or closely crenate-dentate with short broad acute to obtuse teeth, mostly 8–13 cm. long, 3–8 cm. broad, $1\frac{1}{2}$ –2 times longer than

Donia glutinosa R. Br. in Ait. Hort. Kew. ed. 2. 5: 82. 1813; acc. to Ker in Bot. Reg. 3: pl. 187. 1817; acc. to Hook. Fl. Bor. Am. 2: 25. [1834] 1840, in small part, as to synonymy only.

Demetria glutinosa Lag. Gen. & Sp. Nov. 30. 1816.

Aurelia decurrens Cass. Dict. Sci. Nat. 37: 468. 1825.

Grindelia peruviana Schz.-Bip. in Bonplandia 4: 54. 1856.

Grindelia peruana Schz.-Bip. in Lechler, Berber. Am. Austr. 57. 1857, as nomen nudum.

Grindelia montana Phil. Anal. Univ. Sant. 87: 429. 1894; Cabrera in Rev. Mus. La Plata 33: 224. 1931.

Specimens examined in addition to those cited by Cabrera under *G. montana*:

SOUTH AMERICA: PERU—shrub, 1–2 ft. high, Posco, between Mollendo and Arequipa, alt. about 550 m., March 30, 1915, *Cook & Gilbert 42* (US); 2 ft., bushy-branched, sandy hills, desert (after Oct. rains), Mollendo, Arequipa, Nov. 17, 1923, *A. S. Hitchcock 23375* (US); CHILE—Arica, Oct., 1914, *Buinnier 4401* (US); Arica, Jan. 1, 1906, *Sargent* (M).

WITHOUT DEFINITE LOCALITY: “*Aster glutinosus* Cav., sp. nov., Mexico,” ex. herb. Musei Britannici (US part of TYPE, British Museum photograph of TYPE, B); “*Doronicum glutinosum* W., *Aster* Cav.” (M).

It is curious to find that *Grindelia glutinosa* (Cav.) Dunal has passed unidentified. Cabrera in his revision of the South American species of *Grindelia* (Rev. Mus. La Plata 33: 209. 1931) was unable to place *G. glutinosa*, and treated it among his excluded species, saying “Existen además dos especies inclúdas, al parecer erróneamente, en la flora sudamericana. Son ellas *G. squarrosa* . . . y *G. glutinosa* (Cav.) Dun., que Hoffmann, Benthams y Hooker y Hicken citan para el Perú, y Bertero para Chile.

“En cuanto a *G. glutinosa*, las ejemplares de Bertero delien reerirse a *Haplopappus chrysanthemifolius* (Less.) DC. y los de Hicken a *G. Boliviana* Rusby. No sé a qué se deben las citas de Benthams y Hooker y Hoffmann; pero por mi parte, no conozco ninguna especie sudamericana que pueda identificarse con la lámina y descripción de Cavanilles.”

I have before me type material of *Aster glutinosus* Cav. preserved in the United

broad, those on floriferous branchlets 1.5–4 cm. long, 1–3 cm. broad, $1\frac{1}{4}$ –2 times longer than broad, the main and lower cauline broadly or ovoid-oblong, obtuse, amplexicaul to subcordate, those on floriferous branchlets broadly ovoid-oblong, ovate, or suborbicular-ovate, obtuse to acute, strongly amplexicaul, glabrous, crowded subtending the heads; disk 1.1–1.7 cm. high, 1.5–2.5 cm. broad; involucre scarcely resinous, the resinous exudate appearing mostly in bud and before anthesis, the upper third to half of the bracts free and moderately reflexed or spreading, mostly flattened and not conspicuously thickened; awns stout, 2–9, entire to moderately serrulate.

Distribution: open slopes and mesas, Santa Barbara Islands and adjacent coastal California in Santa Barbara and San Luis Obispo Counties, California.

CALIFORNIA: Santa Margarita, San Luis Obispo Co., July 8, 1882, *Summers 386*

States National Herbarium, as well as a photograph of type material taken by Dr. S. F. Blake in the British Museum of Natural History, and a sheet in the Missouri Botanical Garden Herbarium labelled “*Doronicum glutinosum*, *Aster* Cav.,” undoubtedly part of authentic material of *Doronicum glutinosum* Willd. which is synonymous with *Aster glutinosus* Cav.

A comparison of these historical specimens with Cavanilles' excellent plate and clear description shows that they are indeed the plants described as *Aster glutinosus* by Cavanilles. The pappus awns of these specimens are stout and strongly and closely setulose. The next problem was to learn with what existing collections *Aster glutinosus* Cav. could be matched. Cavanilles (*Icones* 2: 53–54. 1793), in his original diagnosis, had stated that he had seen flowering material of his new species in the Royal Gardens of Madrid, and gave the habitat as Mexico. However, no collections have ever been found in Mexico which could be identified with *Aster glutinosus*. Gray (*Syn. Fl. N. Am.* 1²: 119. 1884, and ed. 2. 119. 1888) assumed that this species originally came from the Pacific shores, and tried to identify Kellogg's plant of *Grindelia latifolia* (now *G. rubricaulis* var. *latifolia*) and Bolder's plant of *Grindelia venulosa* (now *G. stricta* f. *venulosa*), both Californian plants, with *Aster glutinosus*. Other authors correctly assumed the locality to be South America; Hoffmann, Bentham and Hooker, and Hicken believed the source of *Aster glutinosus* to be Peru. An examination of herbarium material from South America shows that the species which Cabrera treats in his revision as *G. montana* Phil. is conspecific with *Grindelia glutinosa* (Cav.) Dunal. Most of the herbarium material of this species comes from either the Arica region in Chile, or the Tacna-Arequipa region in Peru. All the specimens show the distinctive stout, strongly and closely setulose pappus awns so characteristic of *G. glutinosa*, as well as the large foliaceous ascending-spreading involueral bracts, and oblanceolate to obovate serrate leaves of this species.

This removes all doubt finally concerning the locality and exact identity of *G. glutinosa*, and leaves certain the fact that *G. glutinosa* is a South American species inhabiting a limited area in Peru and Chile.

in part, as to specimen on left (CAL); Santa Rosa Island, 1872-73, *Harford* (CAS, G TYPE); open mesa, Santa Rosa Island, April 8, 1930, *Hoffmann* (SB); San Miguel Island, Sept., 1886, *Greene* (US); Santa Rosa Island, June, 1888, *T. S. Brandege* (CAL, G); open slopes, Anacapa, June 16, 1930, *Hoffmann* (SB); Concepcion to Jalama, Santa Barbara Co., alt. 30 m., March 29, 1924, *Eggleston* 19587 (PO, US); Suey Creek road, May 27-June 10, 1906, *Eastwood* 396 (CAL, CAS, US); Suey River, near the boundary between Santa Barbara and San Luis Obispo Counties, May 9, 1896, *Eastwood* (G).

44f. var. *latifolia* f. *minor* Steyermark, f. nov.⁶⁶

Stems 4-4.5 dm. tall; main middle and lower cauline leaves 3-4 cm. long, 1.5-2.5 cm. broad, $1\frac{1}{2}$ - $1\frac{3}{4}$ times longer than broad, broadly ovate-oblong or ovate, subcordate or strongly amplexicaul, the middle and lower cauline more sharply and saliently dentate or serrate with acute to spinulose teeth; heads subtended and almost concealed by broadly deltoid-ovate or broadly ovate leaves 1-1.5 cm. broad.

Distribution: coastal bluffs and slopes, Santa Barbara Co., California.

CALIFORNIA: ocean bluffs, Point Arguello, *Hoffmann* (SB); Santa Maria, *Blockman* (CAL); Casmalia sands, country adjacent to Santa Maria, June 13-July 3, 1906, *Eastwood* 794 (CAS, G TYPE, US).

44g. var. *latifolia* f. *pubescens* Steyermark, f. nov.⁶⁷

Stems villous.

Distribution: Monterey Co., California.

CALIFORNIA: between Lucia and Little's Hot Springs, Monterey Co., June 14, 1909, *K. Brandege* (CAL TYPE).

44h. var. *platyphylla* (Greene) Steyermark in Ann. Mo. Bot. Gard. 21: 227. 1934.

G. glutinosa (Cav.) Dunal acc. to Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, as to plant from Lobos Creek, near San Francisco; acc. to Gray, Syn. Fl. N. Am. 1²: 119. 1884, and ed. 2. 119. 1888, only as to plant from San Francisco Bay.

⁶⁶ *G. rubricaulis* var. *latifolia* f. *minor* Steyermark, f. nov., caulibus 4-4.5 dm. altis; foliis principalibus mediis et inferioribus 3-4 cm. longis, 1.5-2.5 cm. latis, $1\frac{1}{2}$ - $1\frac{3}{4}$ plo longioribus quam latis, late ovato-oblongis vel ovatis, subcordatis vel valde amplexicaulibus.—Collected on Casmalia sands, California, June 13-July 3, 1906, *Eastwood* 794 (Gray Herb. TYPE, CAS, US, isotypes).

⁶⁷ *G. rubricaulis* var. *latifolia* f. *pubescens* Steyermark, f. nov., caulibus villosis.—Collected between Lucia and Little's Hot Springs, Monterey Co., California, June 14, 1909, *K. Brandege*, as to specimen on left side of sheet (Univ. of Cal. Herb. no. 468770 TYPE).

G. robusta var. *platyphylla* Greene, Pitt. 2: 289. 1892; Jepson, Man. Fl. Pl. Cal. 1020. 1925.

Stems erect to spreading, 3–5 dm. tall, glabrous; leaves subcoriaceous or firmly membranaceous, thicker than var. *robusta*, coarsely dentate, closely denticulate to entire, the main lower and middle cauline 4–8 cm. long, 1.5–2.5 cm. broad, 2–3 times longer than broad, obtuse to truncate above, amplexicaul, those on the floriferous branchlets numerous, 1–2 cm. long, 0.7–1.5 cm. broad, $1\frac{1}{4}$ –2 times longer than broad, typically obtuse or obtusish and strongly amplexicaul, the main middle and lower cauline broadly oblong to obovate- or rhomboid-oblong or spatulate, the upper cauline and those on floriferous branchlets broadly oblong to rhomboid, subtruncate to acute; involucre with the tips moderately to strongly reflexed, rather more resinous than var. *robusta*.

Distribution: California, mostly in vicinity of Pacific Grove, Monterey Co., in fields, coastal flats, and beaches, in Santa Cruz Co., San Mateo Co., Marin Co., and Santa Rosa and Anacapa Islands.

CALIFORNIA: roadside, in the low land along the Salinas River road from Watsonville to Monterey, Monterey Co., Aug. 20, 1930, *Peirson 9244* (P); Monterey Co., *Abbott* (CAS); wet grounds of brackish marsh, mouth of Waddell Creek, 1.5 miles south of San Mateo Co. line, Santa Cruz Co., Oct. 19, 1932, *J. T. Howell 10862* (CAS, M); Pacific Grove, July 8, 1914, *Newell* (CAS); coastal flats, 17-mile Drive, Pacific Grove, Monterey Co., Aug. 3, 1930, *J. T. Howell 5430* (CAS, G, M); along the beach between Point Pinos and Pacific Grove, June 12, 1903, *Heller 6843* (CAL, D, F, G, M, MA, NY, PA, PO, US); near Castroville, Monterey Co., Oct. 31, 1908, *Dudley* (ST); sandy sea beach, Point Pinos, near Monterey, July 31, 1927, *Blake 10154* (G); Pacific Grove, Monterey Co., Sept., 1902, *Elmer 4065* (G, PO); bluffs of the sea-shore, Pt. Cabrillo, Monterey peninsula, Aug., 1917, *Parish 11459* (PO); Monterey and Pacific Grove, July, 1892, *Howe* (CAL TYPE); ocean bluffs, Pigeon Point, San Mateo Co., June 23, 1933, *Demaree 10378* in part (M); Westpoint Road, Tamalpais, July, 1907, *K. Brandegee* in part (CAL).

44i. var. *platyphylla* f. *villosa* Steyermark, f. nov.⁶⁸

G. hirsutula Hook. & Arn. acc. to Benth. Plant. Hartweg. 317. 1849; acc. to Gray in Geol. Surv. Cal. Bot. 1: 303. 1876, as to plant from Monterey; acc. to Gray, Syn. Fl. N. Am. 1²: 117. 1884, and ed. 2. 117. 1888, as to plant from Monterey.

⁶⁸ *G. rubricaulis* var. *platyphylla* f. *villosa* Steyermark, f. nov., caulibus et saepe foliis plus minusve villosis; foliis caulinis superioribus et illis in ramusculis floriferis plerumque acutis.—Collected at Pacific Grove, coast above Chinatown Point, Monterey Co., California, July 10, 1905, *C. P. Smith 1016* (Gray Herb. TYPE).

Stem and often the leaves more or less villous; upper cauline leaves and those on floriferous branchlets obtuse to acute.

Distribution: occurring with the variety, Pacific Grove and vicinity, Monterey Co., and south along the coast to the vicinity of Morro, San Luis Obispo Co., California.

CALIFORNIA: in fields and pastures near Monterey, 1848, *Hartweg 1786* [46], (G, M); Castroville, April, 1889, *K. Brandegee* (CAL); bluff above sea, Willow Cr.—Morrow region, San Luis Obispo Co., July 30, 1920, *Pierson 2754* (P); Pacific Grove, Monterey Co., May 24, 1899, *Chandler 326* (M); Pt. Carmel, Monterey Co., June 6, 1901, *Setchell* (CAL); Cambria, April 29, 1926, *Eastwood 13674* (CAS); Pacific Grove, coast above Chinatown Point, Monterey Co., July 10, 1905, *C. P. Smith 1016* (G TYPE); Moss Beach, July 15, *K. Brandegee* in part (CAL); ocean bluffs, Pigeon Point, San Mateo Co., June 23, 1933, *Demaree 10378* in part (M); Pebble Beach Ravine, 17-mile Drive, April 30, 1910, *Randall 421* (ST); Carmel bluffs near the sea, Monterey Co., Aug. 17, 1909, *Abrams 4260* (ST).

Heretofore *G. rubricaulis* DC. has been considered to be synonymous with *G. hirsutula* Hook. & Arn., a fallacy which has led to much taxonomic and nomenclatural confusion among variations of *G. hirsutula*, *G. rubricaulis*, and *G. robusta* Nutt. The present author has had an opportunity of examining a fragment and photograph of the type ("California," 1833, *Douglas 55*), as well as an isotype collection of *G. rubricaulis* in the Gray Herbarium. The Douglas specimen has red stems which are glabrous below and loosely villous above, especially towards the heads; the outer and middle involucre bracts are covered with a short crisp pubescence and have very slender definitely recurved tips, while the inner bracts have straight tips. A comparison of this specimen with that of the type collection of *G. hirsutula* shows that in the latter the outer bracts are only slightly recurved at the tips. Moreover, the main cauline leaves of the *G. rubricaulis* type and isotype specimens are firmer and much more saliently dentate than the corresponding ones of *G. hirsutula*. The uppermost leaves of *G. rubricaulis*, as shown on the type collections, are mostly triangular-ovate or ovate-lanceolate with strongly clasping bases, whereas in *G. hirsutula* the uppermost leaves are more oblong-lanceolate to oblong and less amplexicaul.

It is well known that Douglas, on one of his western trips, collected for a short time in the Monterey Bay region. Several specimens have been collected in that locality which seem to

match the *Douglas* plant—such collections as “in pasture near Pescadero Ranch, Monterey Co., May 25, 1861, *Brewer 657* (*Guirado*),” “near Santa Rita, Monterey Co., May, 1889, *Abbott*,” “near Del Monte Lodge on Carmel Bay, Monterey Co., among *Pinus radiata*, Aug. 19, 1933, *J. T. Howell 11602*,” and “Monterey, June 14, 1889, *K. Brandegees*.”

These specimens have the strongly recurved or revolute slender involucre tips, more or less foliaceous outer bracts subtending heads (to a greater or lesser degree), triangular-ovate or ovate-lanceolate leaves on the floriferous branchlets, and sharply dentate cauline leaves, at least in part. The evidence, therefore, shows that the plant of Douglas is well matched by collections in the Monterey Bay region, where he undoubtedly collected it. The *G. rubricaulis* DC., not authors, has slender recurved or revolute-tipped involucre bracts, whereas the *G. hirsutula* Hook. & Arn. and varieties (*G. rubricaulis* of many authors, not DC.) have involucre bracts with shorter erect-appressed or ascending-spreading tips which only exceptionally become more recurved.

In view of the fact that *G. rubricaulis* DC. grades imperceptibly into villous forms of *G. robusta* var. *platyphylla* Greene, around Pacific Grove, Pt. Carmel region, and elsewhere around Monterey, and since *G. robusta* var. *platyphylla* intergrades into *G. robusta* and *G. robusta* var. *latifolia*, it becomes quite necessary, though very unfortunate, to consider all variations of the *G. robusta* Nutt. complex as belonging under *G. rubricaulis* DC., since this name, published in 1836, antedates by five years the date of publication of *G. robusta* Nutt. It would be well if it were possible to conserve the name *G. robusta* Nutt. as a unit specifically distinct from *G. rubricaulis* DC., and thereby prevent so many changes in nomenclature, but a very large series of specimens has shown a bewildering amount of variation and intergradation in pubescence, leaf shape, involucre bracts, size of heads, etc.

The real identity of *G. cuneifolia* Nutt., not authors, was solved only after several years of study. Nuttall had seen only two small branches (which he may not even personally have

collected, but which may have been collected for him by some other party), one of which is preserved in the British Museum and the other at Gray Herbarium; both are fragmentary and were collected at Santa Barbara. In the few involucre bracts still attached to the head of the Gray Herbarium fragment the tips are recurved and the head subtended by numerous reduced leaves. Later, Nuttall's fragments were identified with the common salt-marsh species (*G. humilis* Hook. & Arn.) of San Francisco Bay, and in this way the true identity of *G. cuneifolia* Nutt. was obscured. Since no specimens which matched the salt-marsh plants of San Francisco Bay had ever been collected around Santa Barbara, a region much visited by botanical collectors, it became obvious that Nuttall had collected some species other than *G. humilis* of the salt marshes. Examination of numerous herbarium specimens of *Grindelia* collected from Santa Barbara and adjacent coastal region revealed the fact that *G. rubricaulis* var. *robusta* (*G. robusta* Nutt.) was the form commonly collected in that area, but the perplexing phase of the problem was that in all the collections examined the upper leaves averaged much broader and were of a different shape from the Nuttall fragment of *G. cuneifolia*. Finally, however, the present author had occasion to examine a collection from the Pomona College Herbarium of the *Abrams 3273* specimen, collected at San Juan Capistrano, Orange Co., April 19, 1903. Most of this material consisted of broader acute upper leaves, as is typical of the var. *robusta*, and this well matched the other collections of *Abrams 3273* from the University of California Herbarium, California Academy of Sciences Herbarium, and New York Botanical Garden Herbarium. However, in the lower center of the sheet in the Pomona College Herbarium is a fragment of an upper branch of the *Abrams 3273* plant, which in all respects matches perfectly the type of *G. cuneifolia* Nutt. Furthermore, in growing from seeds plants of typical *G. rubricaulis* var. *robusta* collected by J. T. Howell 5179 from Summerland (near Santa Barbara), Santa Barbara Co., the writer has been able to find, though very rarely,

branchlets which had abnormally narrow subentire or entire leaves crowded beneath the heads, and which in every way matched the sort of branchlet which Nuttall described for *G. cuneifolia*. *Grindelia cuneifolia* Nutt. then proves to be merely an abnormal or rarely collected narrowly foliose shoot of *G. rubricaulis* var. *robusta*, and such shoots occur on otherwise typical plants. The writer has observed a similar case of this abnormal foliose condition in other varieties and forms of *G. rubricaulis*.

Likewise, Jones's *G. pacifica* is an abnormal or weakly developed plant having loosely spreading thin involucral bracts; this sort of growth may be found in young, weak, or abnormally developed small shoots of otherwise typical *G. rubricaulis* var. *robusta*, and is in no sense to be given valid taxonomic status.

45. *G. arenicola* Steyermark in Ann. Mo. Bot. Gard. **21**: 224. 1934.

G. cuneifolia Nutt. acc. to Peck in Am. Jour. Bot. **12**: 46. 1925.

Herbaceous perennial; stems prostrate, ascending to erect, 1 to several from a subligneous base, the base elongated and giving rise at the nodes to herbaceous shoots of the season, the floriferous branchlets loosely corymbosely branched above with divergent branchlets bearing few heads, or the branchlets elongated and simple and bearing only a single terminal head, stramineous or green to suffused with rose- or pink-purple, glabrous, 2–5 dm. tall; leaves firm to subcoriaceous, abundantly and rather conspicuously resinous-punctate, the main cauline sharply serrulate to dentate, often only above the middle, those on the floriferous branchlets frequently reduced, crowded, and entire, 1.2–8 cm. long, 0.2–3.5 cm. broad, $2\frac{1}{2}$ –5 times longer than broad, the radical or basal cuneate, broadly oblong-spatulate or obovate-cuneate, obtuse or subtruncate at apex, the others spatulate or oblong to (the uppermost) sometimes linear-lanceolate, obtuse to acute, conspicuously narrowed below the middle to sometimes (the upper) amplexicaul, glabrous; heads radiate, 2.5–4 cm. broad; disk campanulate-

hemispherical, 0.8–1.2 cm. high, 1.2–2 cm. broad; involucre abundantly and conspicuously resinous, bracts 3.5–10 mm. long, lanceolate with rather elongated subulate tips, frequently merging into the leaves on the floriferous branchlets, the upper third to half with free loosely revolute or strongly reflexed tips, glabrous; rays 19–34, bright yellow or orange-yellow, the lamina 0.9–1.4 cm. long; achenes oblong, 3–4.5 mm. long, 1.3–1.5 mm. broad, smooth to slightly striate, obliquely auriculate, bordered at one angle, or appearing truncate at apex; awns mostly 3–5 to the floret, remotely to mostly moderately



Fig. 38. *G. arenicola*. $\times \frac{1}{6}$.

serrulate or setulose-serrulate, sometimes setulose, 3–4.5 mm. long, $\frac{2}{3}$ – $\frac{3}{4}$ length of disk-floret.

Distribution: wet places in sand dunes, sand beaches, on sands on coastal mesas scattered along the coast from Coos Co., Oregon, south along the Californian coast to Carmel and Cypress Point, Monterey Co., and locally south on Santa Rosa Islands, Santa Barbara County.

OREGON: on beach at Bandon, Coos Co., Aug. 29, 1929, *Ferris 7806* (NY); sand dunes at Bandon, Coos Co., Aug. 14, 1928, *Gale 366* (G); moist sandy ground, mouth of Winchuck River, Curry Co., July 11, 1929, *Henderson 11419* (UO); margin of shore bluff, Bandon, July 31, 1919, *Peck 8992* (WI); seaward margin of coast bluff, The Heads, Port Orford, June 20, 1919, *Peck 9074* (WI).

CALIFORNIA: Fort Bragg, Mendocino Co., Aug. 8-16, 1912, *Eastwood 1592* (CAS, G, US); Fort Bragg, Mendocino Co., July 14-16, 1915, *A. S. Hitchcock* (US); 4 miles north of Crescent City, near beach, Aug. 9, 1923, *M. S. Baker 221b* (B); Cypress Point, Monterey, Nov. 9, 1912, *Eastwood 2424* (CAS); common in swale-like hollows in sand dunes, Mendocino Coastal plain, 4.5 miles north of Fort Bragg, Mendocino Co., Sept. 14, 1930, *J. T. Howell 5473* (CAL, CAS TYPE, G, M, PO); dunes, Carmel, Jan. 7-10, 1910, *Mrs. T. C. Pease* (G); open hillsides, Santa Rosa Island, April 9, 1930, *Hoffmann* (SB); along coast highway, between Pt. Arena and Anchor Bay, June 27, 1931, *M. S. Baker 5261* (B); along coast, Carmel-by-the-sea, March 27, 1910, *Randall 122* (ST); near beach, Carmel-by-the-sea, Feb. 13, 1910, *Randall 25* (ST); near lagoon, Crescent City, Del Norte Co., 1899, *Dudley* (ST).

45a. var. pachyphylla Steyermark, var. nov.⁶⁹

Stems prostrate to ascending, the herbaceous shoots from a ligneous base or the shoots of the season developing from the older ligneous axes; leaves thick and coriaceous; reflexed or revolute tips of the involucre bracts thicker.

Distribution: open coastal plain and marine bluffs in Marin, San Mateo, Sonoma, and Mendocino Counties, California, and locally in southern Oregon.

OREGON: The Heads, Port Orford, Aug. 14, 1924, *Peck 13635* (WI).

CALIFORNIA: Moss Beach, San Mateo Co., July 15, 1917, *K. Brandegee* in part, as to specimen on left (PO); Bodega Point, Sonoma Co., Sept. 30, 1900, *Eastwood* (NY); open coastal plain, 6 miles south of Point Arena, Mendocino Co., Sept. 27, 1931, *J. T. Howell 8106* (CAS TYPE, G, M); marine bluff, 4 miles north of Bodega Bay, Sonoma Co., June 8, 1930, *J. T. Howell 5294* (CAS); sea-shore below Point Arenos, Mendocino Co., Aug. 8, 1901, *Congdon* (US); sand dunes, Pt. Reyes, Marin Co., Oct. 15, 1932, *Booth* (E); Point Reyes peninsula, June-July 1899, *Davy* (CAL); sea bluffs at Pescadero Beach, San Mateo Co., July 4, 1929, *Wiggins 3799* (CAL); Moss Beach, San Mateo Co., Oct. 26, 1924, *J. T. Howell 724* (CAS); Montara Point, San Mateo Co., June 7, 1903, *Copeland* (N, PO); sandy ocean bluffs, Montara, San Mateo Co., July 21, 1933, *Rose 33306* (CAS, M); San Francisco, Nov. 5, 1930, *Rose* (B); near Halfmoon Bay, sandy open hill near beach, coast road to Halfmoon Bay, San Mateo Co., June 22, 1922, *McMinn 252* (ST); suffrutescent on permanent dunes, Pt. Reyes peninsula (north shore), Marin Co., Nov. 5, 1933, *Ewan 8098* (E).

45b. f. trichophora Steyermark, f. nov.⁷⁰

Stems villous or hirsute; leaves firm and subcoriaceous, closely or scarcely villous-puberulent to glabrate.

⁶⁹ *Grindelia arenicola* var. *pachyphylla* Steyermark, var. nov., foliis crassis et coriaceis; bracteis involucri crassioribus.—Collected on open coastal plain, 6 mi. south of Point Arena, Mendocino Co., California, Sept. 27, 1931, *J. T. Howell 8106* (Cal. Acad. Sci. Herb. no. 188433 TYPE, G, M, isotypes).

⁷⁰ *Grindelia arenicola* f. *trichophora* Steyermark, f. nov., caulibus villosis vel hirsutis; foliis plerumque villosopuberulis.—Collected at Halfmoon Bay, San Mateo Co., California, 1913, *W. F. Schmitt* (U. S. Nat. Herb. no. 880080 TYPE).

Distribution: along the coast of California, in Marin, San Mateo, and Mendocino Counties.

CALIFORNIA: Fort Bragg, July 12, 1931, *M. E. Jones* 29141 (CAL, M); Granada, San Mateo Co., June 2, 1912, *Eastwood* 216 (CAS, G); Halfmoon Bay, San Mateo Co., 1913, *Schmitt* (US TYPE); San Mateo Co., Aug. 6, 1915, *Drushel* (M); Moss Beach, San Mateo Co., July 15, 1917, *K. Brandegees* in part, as to specimen on right (PO); ocean bluffs near lighthouse, Point Reyes, Marin Co., April 19, 1927, *Abrams* 11591, 11591a (ST); common in fields surmounting ocean, Fort Bragg, Mendocino Co., July 6, 1920, *Duncan* 165 (ST); coast, Pt. Reyes, Marin Co., April 19, 1927, *Chien P'ei* 411 (B).

Grindelia arenicola, recently described, is quite typical of the sand dunes, sand beaches, and sands of the coastal mesa from southern Oregon south locally to San Mateo and Monterey Counties. The regularly serrate spatulate to oblanceolate-spatulate main lower and middle leaves of the species and varieties are broadly rounded at the apex, a character which serves to distinguish them from *G. stricta* var. *procumbens*, which has narrowly oblong or oblanceolate and acute lower and middle leaves. While *G. arenicola* and varieties and *G. stricta* var. *procumbens* have some of the stems procumbent and caespitose, those of *G. stricta* var. *procumbens* are nearly herbaceous throughout, while in *G. arenicola* and varieties the flowering stems mostly arise from elongated ligneous axes. In *G. stricta* var. *procumbens* the flowering stems curve upwards from an otherwise procumbent stem, while in *G. arenicola* and varieties the flowering shoots become more erect and ascending. Moreover, in *G. arenicola* and varieties the involucre bracts are strongly recurved or revolute, whereas in *G. stricta* var. *procumbens* they are more reflexed and squarrose and not revolute.

Within and at the margins of the range of *G. arenicola* and varieties several other entities occur, such as *G. stricta* and var. *procumbens* and *G. rubricaulis* var. *platyphylla*. Some collections have been taken which may represent hybrids between some of the entities mentioned above. For example, near the southern limit of dispersal of *G. arenicola*, near Carmel, Monterey Co., California, a region where *G. rubricaulis* var. *platyphylla* also occurs, we find collections, such as *J. T. Howell* 11608, which are intermediate between *G. arenicola*

and *G. rubricaulis* var. *platyphylla*. Again, at places where *G. stricta* var. *procumbens* and *G. arenicola* approach each other within their ranges or near their limits, we encounter specimens somewhat intermediate between these two. Such a collection is that of *Applegate* 5224 from bluffs along the seashore, Crescent City, Del Norte Co., Cal., collected June 20, 1926. At the northern limit of dispersal for *G. arenicola*, in southern Oregon, specimens are found intermediate between that species and *G. stricta* which occurs near this area (*Henderson* 11454 from Hauser, Coos Co., *Henderson* 11420 from Coos Bay, Coos Co., and others). A specimen, intermediate between the two forementioned species, of *Scullen* from top of sea-cliff, Shore-Acres, Coos Co., Oregon, collected July 18, 1926, may be of hybrid origin. Other collections taken in California which may be hybrids between *G. stricta* and *G. arenicola* are those of *Wolf* 1319 from 3 miles north of Westport, Mendocino Co., and *Wolf* 1214 from the Devil's Gate, south of Cape Mendocino, Humboldt Co.

EXCLUDED SPECIES

Donia canariensis Less. Syn. Gen. Compos. 199. 1832 = *Jasonia laevigata* (Brouss.) DC.

Donia ciliata Nutt. in Jour. Acad. Nat. Sci. Phila. 2: 118. 1821 = *Aplopappus ciliatus* (Nutt.) DC.

Donia lanceolata Hook. Fl. Bor. Am. 2: 25. [1834] 1840 = *Aplopappus lanceolatus* (Hook.) Torr. & Gray.

Donia uniflora Hook. Fl. Bor. Am. 2: 25. [1834] 1840 = *Aplopappus uniflorus* (Hook.) Torr. & Gray.

Grindelia pulchella Bert. Merc. Chil. 643. 1829, not *G. pulchella* Dunal = *Aplopappus pulchellus* (Bert.) DC.

Grindelia acerosa Bert. Merc. Chil. 643. 1829 = *Aplopappus integerrimus* (Hook. & Arn.) Hall.

Grindelia canescens Bert. Merc. Chil. 643. 1829 = *Aplopappus canescens* (Phil.) Reiche.

Grindelia glutinosa Bert. Merc. Chil. 646. 1829, not *G. glutinosa* Dunal = *Aplopappus chrysanthemifolius* (Less.) DC.

Grindelia incisa Spreng. Syst. **3**: 575. 1826 = *Aster incisus* Fisch.

Grindelia sibirica Spreng. ex Link, Enum. Pl. Hort. Berol. **2**: 336. 1821. = *Aster sibiricus* L.

Grindelia caucasica Spreng. ex Steud. Nom. Bot. ed. 2. **1**: 707. 1841 = *Aster caucasicus* Willd.

Grindelia coronopifolia Lehm. Ind. Sem. Hort. Hamb. 16. 1828 = *Xanthocephalum centauroides* Willd.

Grindelia stylosa Eastw. in Proc. Cal. Acad. II. **6**: 293. 1896 = *Vanclevea stylosa* (Eastw.) Greene.

Grindelia andina (Phil.) Phil. in Linnaea **33**: 137. 1864 = *Chrysophthalmum andinum* Phil. in Linnaea **29**: 9. 1857. There is, however, an earlier published *Chrysophthalmum* Schz.-Bip. in Walp. Rep. **2**: 955. 1843.

LIST OF EXSICCATAE

The distribution numbers are printed in *italics*. Unnumbered collections are indicated by a dash. The numbers in parentheses are the species numbers used in this revision.

- | | |
|--|---|
| Abbott, E. K. — (44); — (44h). | Baker, H. P. — (12); — (12d); — (38). |
| Abrams, L. R. 3957 (30); 6751, 7705 (31); 5393 (34); 6727 (34a); 12585 (34c); 9530 (35); 5751, 6889 (42c); 3903 (44b); 3072, 4105 (44d). | Baker, M. S. — (35c); — (35e); 221b, 526 (45). |
| Abrams, L. R. & E. A. McGregor. 626 (12d). | Baker, C. F., F. S. Earle & S. M. Tracy. 526 (15); 497, 600 (21a); 538 (23a). |
| Adams, J. Q. — (44d). | Ballard, C. A. 2554 (12d). |
| Aiton, G. B. — (12); — (13). | Barber, J. H. — (44d); — (44i). |
| Ames, M. E. P. — (34d). | Bardell, E. M. — (39d). |
| Anderson, A. P. — (12). | Barham, A. R. — (13). |
| Anderson, W. B. — (13). | Basil, H. B. — (39). |
| Anect, Bro. 12 (15). | Bates, J. M. —, 2592 (12). |
| Arsène, G. 5697, 5823 (1). | Beard, A. — (24a). |
| Arsène, G. & Bro. Abbon. 101 (7). | Beckwith, F. 218 (19). |
| Atkinson — (42e). | Beechey, F. W. — (42). |
| Austin, R. M. 1953 (34d); 1614, —, 572 (35c). | Berlandier, J. L. 766 (7); 647 (8); 541 (12b). |
| Babcock, E. B. & J. L. Collins. 84 (35); 52 (38). | Bertrand, Bro. 80 (21a). |
| Bailey, V. 256a (8b). | Bethel, E. — (17a). |
| Baker, C. F. — (12d); 702 (21); 683 (21a); 682 (23a); 47 (32); 2916 (34f); —, 687, 812 (42a). | Bethel, E., F. S. Willey & I. W. Clokey. 4321 (20a). |
| | Bigelow, J. M. — (34e). |
| | Binns, F. — (39d). |
| | Bipontinus, S. — (37). |

- Bioletti, F. T. — (34); — (42d).
 Blaisdell, F. E. — (34e).
 Blake, S. F. 10328 (32); 10385 (37b);
 10367 (39); 10368 (41); 9943, 9949
 (42e); 9998, 10000, 10159 (43);
 10154 (44h); 10157 (44i).
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 — (35d).
 Blewitt, A. E. — (12d).
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 Bodin, J. E. — (12b).
 Bolander, H. N. 2425 (32); 6493 (39a);
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 Bourgeau, M. 515 (1); — (13).
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 (44h); — (44i); — (45a); — (45b).
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 — (31); — (34); — (34d); —
 (35c); — (35e); — (42); — (44);
 — (44b); — (44e).
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 (44d).
 Bray, W. L. 448 (12c).
 Brewer, W. H. 850 (34); 1290 (34d);
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 Bush, B. F. —, 4093 (12); 390 (12b);
 — (12c); 9174 (12d); 220 (26).
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 Cannon, G. L. — (12d).
 Carroll, J. A. — (12).
 Carter, L. W. — (13).
 Carter, W. K. — (39).
 Carter, W. R. — (39i).
 Chandler, B. F. — (12).
 Chandler, H. P. 5460 (30); 7604 (34e);
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 Chestnut, V. K. 547 (35c).
 Clark, J. A. 270 (35b).
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 Clemens, Mr. & Mrs. J. 948 (8b); 949
 (25).
 Clemens, M. S. — (37b).
 Clements, F. E. & E. S. 243 (44b).
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 Commons, A. — (12).
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 Deam, E. & A. J. Eames. 5096 (12d).
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- Drushel, J. A. 4165 (8b); — (17a); — (45b).
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